CE LIBRARY

ENGINEERING & MINING JOURNAL-PRESS

A CONSOLIDATION OF ENGINEERING AND MINING JOURNAL AND MINING AND SCIENTIFIC PRESS

McGRAW-HILL CO. INC.

PRICE 15 CENTS

The Mayo District in Yukon Territory

By Charles Francis Williams

The Marketing of Soapstone

By Raymond B. Ladoo

Geological Experts—What the Judge Thinks

By Doska W. E. Monical

The Geological Department of Phelps Dodge Corporation at Tyrone, N. M.

By Djevad Eyoub

Ajo Enterprise of New Cornelia Copper Co.—III

By A. W. Allen

Frazer Falls of Stewart River, Yukon Territory. Thirty-two miles from Keno Hill in the new Mayo silver-lead district.

A WEEKLY JOURNAL REPRESENTING THE WORLD'S MINING AND METAL INDUSTRIES

June 17, 1922

All-Steel Ball Bearing Carriers

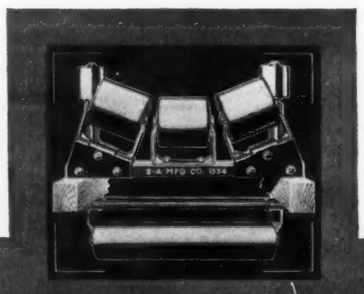
ALL-STEEL—No other construction offers the great strength with the comparative light weight of the all-steel design. The S-A Steel Unit is practically indestructible. The steel tubing rolls have a smooth surface for contact with the belt.

BALL BEARING—To reduce friction the ball bearing gives the best results. Each unit has two ball bearings, each one having far greater load carrying capacity than is ever required in conveyor service. The smooth, easy-turning rolls mean long belt life.

The "S-A Belt Conveyors" Catalog No. 26 is a handbook of valuable information concerning the latest machinery equipment for belt conveyors. Illustrations, descriptions and tabular matter are available for quick reference.

Send for Your Copy.

S-A Unit Carrier—Patented



Stephens-Adamson Mfg. Co.
Aurora, Illinois

T. A. RICKARD
Contributing Editor

G. J. YOUNG, Western Editor
D. E. A. CHARLTON, Managing Editor
A. H. HUBBELL, News Editor
E. H. ROBIE, Metallurgical Editor

ENGINEERING & MINING JOURNAL-PRESS

J. E. SPURR, Editor

F. E. WORMSER
W. N. P. REED
A. W. ALLEN
A. B. PARSONS
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
Special Consulting Editors

Volume 113 | New York, June 17, 1922 | *Number* 24

A Silver Export Association

WHAT WILL HAPPEN to the price which will be paid American producers of silver after the expiration of the effectiveness of the Pittman Act (which will occur in two years or less) is a problem which is naturally engaging the attention of American miners. Since the principal market for the world's silver lies in Asia—in China and India chiefly—it is suggested by H. N. Lawrie, managing director of the American Gold and Silver Institute, that a Silver Export Association be formed, under the provisions of the Webb Act, to market silver in foreign countries. It would seem as if this suggestion were worthy of serious consideration by our silver producers.

At present the central silver market of the world is in London, although the United States and Mexico together produce 70 per cent of the world's silver. But, due to England's suzerainty of India, and her dominating trade position in China, it follows naturally that commercial, financial, and fiscal transactions center in London; hence, as has often been pointed out, the difficulty or inadvisability of transferring the silver open market from London to New York. But the idea of a Silver Export Association works well with existing conditions; and should prove of substantial benefit in securing higher prices for silver in the world market, and in avoiding the great depression and inflations of the silver quotations—smoothing out, in respect to silver, those high and low points of prosperity which constitute the "business cycle," whose extremes could well be minimized for general prosperity, as Mr. Hoover has recently pointed out.

Specific Gravity Sampling

THE SUBJECT OF SAMPLING and estimating ore in a mine is an important one, to which many contributions have been made, and which continues to be a perennial topic for discussion. The mechanical methods of cutting, grinding, and quartering, and thus obtaining a fair average sample, are well understood, though usually not practiced with sufficient care. Before this in importance, however, comes the knowledge of how to place the cuts—how long and in what direction and how far spaced. Great accuracy of observation, a true perception of the form and probable extent of the orebody, is a prime requisite to an accurate sampler. Thus, sampling lies essentially in the province of the expert and experienced mine geologist, of the type which has been developed in recent years, who combines with the knowledge of his special field familiarity with careful engineering methods.

Of first importance, then, is the placing and length of cuts; and an intelligent perception of what each cut means. This will not only enable accurate sampling, but will save waste. A great deal of country rock is uselessly sampled by unintelligent routine methods; or, frequently, cuts are made partly in ore and partly in country rock and so are of no value and even vitiate the results.

Next comes the accuracy of the sampling and the quartering—a mechanical requirement, most often observed.

Third comes the assaying, usually not sufficiently checked up. Samples are bound to be occasionally uneven; assayers are bound to be occasionally careless. The only safe system, where an important enterprise hinges on the result, is a triplicate of each sample, part to be assayed by a different assayer, under a system of secret numbering which will avoid comparison among the assayers. In the not uncommon case of a wide divergence, the agreement of two will commonly point out the third, who has made an error; and in nine cases out of ten a reassay will check this conclusion.

Finally comes the estimation of tonnage. Tonnage resolves itself into two factors—cubic contents and specific gravity. In the estimation of the former an accurate and shrewd geological knowledge is absolutely indispensable, since in all cases, practically, invisible ore must be estimated, even in the "ore in sight"; and when it comes to less fully developed ore, the best possible comprehension of its probable attitude and extent is everything.

As to the other factor—specific gravity—it is astonishing that it is so easily determined, so generally guessed at. Quartz measures thirteen cubic feet to the ton; and engineers are prone to assume that as a base. But as quartz becomes mixed with carbonates, fluorite, barite, or sulphides, or other ore-minerals, or as it decreases or almost disappears, it is evident that this is no more accurate a base than would be the volume of galena to the ton; that is to say, that it is totally unsuitable. Numerous specific-gravity measurements of large blocks of ore, systematically conducted, just as in chemical sampling, are essential to any ore-estimation that is to be dignified by the name of engineering. Weighing these blocks, first in air, and then in water, makes possible swift and accurate specific-gravity determinations, which are to be averaged algebraically (that is, by the weighted method), in proportion to the volume represented by each.

It is quite certain that if sampling were more scientifically conducted, we should have fewer discordances between engineers' estimates and the results of mining; and we would have a less glaring lack of unanimity between the results of the examination of the same mine, by different engineers, than at present.

The Wonderful Pauling Process

DURING THE DOG DAYS of last summer we received a bulletin from the U. S. Department of Commerce describing a recent invention of a German chemist, Harry Pauling, for the extracting of metals from ores, which seemed so preposterous in its claims that, on the basis of the published information,

we derided the whole idea. Our opinion was given in a captious editorial published in the *Engineering and Mining Journal* of July 16, 1921. We find, however, that the claims of Herr Pauling really attracted considerable attention in this country; so much so that many samples of ore were forwarded to the German headquarters, and one company actually went so far as to send four representatives to Germany to investigate the process and to secure an American license for its use if it lived up to its promises. Now these investigators have returned with the sad story, and the metallurgical equipment of a well-known Nevada mining company will not be scrapped after all.

As is usual in developments of this kind, the original prospectus was strong on claims, but the wonderful secrets were not to be divulged until some future time when business relations had been completed. More weight than usual was given to the inventor's statements, because he was a chemist of some note, and his work was attested to by Professor Rheichenstein, also a scientist of reputation.

The sample of concentrate which the investigators carried with them contained about 30 per cent of iron, 32 per cent of sulphur, 3 per cent of copper, 22 per cent of "insoluble," 4 oz. of gold, and 3 oz. of silver. According to the prospectus, every metal present could be easily and simply recovered by solution methods, in an absolutely pure form.

When it came time for a show-down, a small quantity of the concentrate was treated with concentrated nitric acid until the sulphides were completely oxidized and the concentrate was disintegrated. Each metal was then precipitated by well-known methods of qualitative analysis. The investigators inquired what the relation was between this procedure and the Pauling process, and were somewhat amazed when told that that *was* the Pauling process. The nitric acid used is partly recovered. Considerable stress is also placed on the reaction of ferric nitrate and copper sulphide, the copper being recovered as a nitrate, the iron precipitated as a hydrate, and the sulphur as pure sulphur.

In short, the process embraced no reactions which are not thoroughly understood by every able metallurgical chemist. To decompose and neutralize the gangue in most ores would require enormous consumption of nitric acid; the handling of the acid itself would be a big problem; the market for the byproducts would be narrow or non-existent in most instances; and grinding and concentration would not be eliminated, nor would the final melting down of the bullion. It is probable that not one ore on this continent could be more economically treated by this process than by some other.

The best that can be said for the promoters of this fiasco is that they were thought to be honest, and that had they been men of more metallurgical experience they would probably not have put forth the claims that they did.

Also, the process would have more prospects of success in Germany than elsewhere, owing to the labor and nitric acid being cheap and metals being scarce. Furthermore, the process has given some prospect of commercial success in a small plant at Velten for producing copper sulphate from brass scrap, under German conditions of supply and demand.

It is greatly to the credit of E. A. Richter, of Berlin and New York, who was an intermediary between the German promoters and certain mining interests in this country, that the facts about the economic application of this process are now made public. We believe that Mr. Richter followed his honest convictions and that the process was really thought, by himself and other responsible people, to be worthy of investigation. It would be to the public interest if all investigations which turn out negatively could receive equal publicity.

So now we can go back to our knitting, casting our eyes up occasionally to more or less important rumors from Denver and points West.

Boosting Brass and Copper

THE ADVERTISING CAMPAIGN of the Copper & Brass Research Association will serve a useful educative purpose. The arguments given and illustrated appeal strongly to those who are interested in building operations and who consider the permanence of such work. There is no doubt that this is an important field for expansion, but we would suggest that efforts should be made to absorb some of the spending money of the average citizen. The public should be made to see that copper is a metal of great utility and low cost, suitable for many articles beside shingles and guttering. If the campaign for the popularization of the red metal is to go "over the top," it should be recognized that the average citizen's interest must be stimulated.

Some months ago we were told, particularly those of us in Western states, to "buy something made of copper"; but the advice was impracticable. No more beautiful metal is known. Either the raw metal or the alloy, brass, is suitable for the manufacture of a thousand and one articles of ornament and utility that are in continuous demand, the extensive sale of which would absorb much copper. This, however, would be of insignificant import to the copper industry compared with the educative results that would follow a nation-wide familiarization with the metal. However, as before mentioned, the average citizen is helpless. There is little or no demand for articles made of copper and brass, because of the absurd prices asked by the retailer—prices that are maintained because there is no demand. Thus it is that a closed circuit of inactivity is being maintained caused by the apathy of the producers and the gullibility of the producers and buyers.

A recent experience may be cited: The largest store in one of the principal cities of the United States was combed for a plain desk set with all-metal accessories for home use. The prices were ludicrous. The climax was reached when $4.50 was asked for a small brass postage-stamp box, weighing a few ounces. It was suggested to the salesman that the article in question be put away in a safe, whereupon he attempted to justify the price by remarking that it was pure brass! After an experience or two such as this the citizen of average means is disgusted with the buy-something-made-of-copper campaign and disheartened at the results of his efforts to do his share to relieve a stagnant market.

Retailers are educating the public to believe that copper and brass should be classed among the precious metals. It is time to combat this stupid policy with a vigorous corrective. The Copper & Brass Research Association might well issue to the public a plain statement as to the present market prices of the base metals in which they are interested. An advertisement to the following effect would do much to stimulate buying and

discontinue profiteering: "Copper is selling for about 14c. per pound; zinc, about 6c. per pound. Brass is an alloy of the two. Cost of articles made of either should include only a reasonable charge for fabrication and marketing." A knowledge of the facts on the part of the buying public would make the retailers and those behind them "sit up and take notice." The ultimate result would be beneficial to the mining industry, to the public, and to the retailer, for a market would be fostered for the goods and a steady demand would result.

Preparing Ore for Cyanide Treatment

THE NEED for the destruction of cyanicides as a preliminary to the chemical treatment of a gold or silver ore has been disregarded in many up-to-date plants. Too much attention has been paid to the ease with which the precious metals may be dissolved in the milling circuit, and too little to the cost of the operation and the difficulty of ultimate recovery. The instability of the solvent is such that it would appear obvious that every precaution should be taken to see that chemical conditions are as nearly ideal as possible, for generally they are easily controllable. A recognition of the beneficial effects of a preliminary treatment with alkali has recently made possible the extension of cyaniding operations on the Comstock, with satisfactory metallurgic and economic results.

An interesting sidelight on such preliminary treatment is seen in the change of practice at what is known as the high-grade mill of the Nipissing company. The mixture of concentrate, custom ore, and byproducts, averaging about 100 oz. silver per ton, was formerly ground in a tube mill with water and bleaching powder, as a preliminary to cyanide treatment. This procedure is now replaced by one in which the material is first ground and then agitated in a 3 per cent solution of sulphuric acid. The bulk of the liquor containing the removed cyanicides is then displaced by water, the acid left after this treatment being neutralized with lime. The saving in cyanide amounts to about 25 lb. per ton of material treated.

Scope for so radical a reduction in the consumption of solvent exists in few if any other plants in which cyanidation is being practiced; but it has been proved in many instances in which ordinary practice is being followed that the efficient preliminary wet treatment of a gold or silver ore is usually an important factor in reducing the subsequent cost of chemico-metallurgical operations. It also facilitates the recovery of a maximum amount of gold and silver.

Industrial Fatigue

INDUSTRIAL FATIGUE, according to the popular idea, may be defined as the enervation that results from repetitive manual labor. Like many other catch phrases of recent birth, it is difficult to analyze, for there is no reason why such enervation might not spring from mental as well as from physical effort. However, despite the difficulty of analyzing or limiting the application of the term, it is evident that fatigue must be considered as an important factor in industrial life; the subject is one that merits discussion.

Present-day activity is on an intensive scale, for we aim at a high standard of excellence and efficiency. Anything that stands in the way of the attainment of an ideal should be subjected to criticism. Industrial fatigue, using the term in its broadest sense, is common; that much must be admitted. This is evidenced, first, by carelessness and accidents, and an excessive labor turnover afterward. The problem is not so insistent in connection with mining and metallurgy as it is in many other industries, for although much of the work done is of repetitive nature, there is usually a variety of interest involved that prevents boredom and obviates lassitude. However, the future must be considered as well as the present, and on looking forward one is bound to realize that successful co-operation may be the salvation of the mineral industries. Such co-operation is seen already in important consolidations between companies interested only in the mining and production of metals with those concerned with their fabrication. Co-operative effort such as this will involve an added responsibility in connection with an increase in repetitive labor, much of which, it may be anticipated with assurance, will be performed by machine. Some, however, must involve personal attention; hence the need for consideration of the subject.

The division of each twenty-four hours into three shifts of eight hours apiece was the first logical step toward the mitigation of industrial fatigue. Soon after the war broke out in Europe the American embassy in London was besieged with applicants for advice and relief. The result was chaos—and industrial fatigue. It was Hoover who took the common-sense attitude; for he divided the working day into three shifts of eight hours each, and so the problem was solved without fuss. Many of the older members of the mining profession remember when the twelve-hour shift was customary.

Next to the establishment of a rational period for recreation and rest comes the necessity of seeing that the conditions of work are as varied as possible. This is practicable in most instances in which the eight-hour shift is in vogue. Statistics show that the work of men who "change and change about" is as efficient as that of those who work only on the day shift. A regular change in regard to the hours of work is a preventive of industrial fatigue; it permits time and opportunity for recreation and leisure and for indulgence in hobbies; and this draws attention to a question of national as well as of individual importance.

What does the average worker do with his spare time, whether he be laborer, artisan, or salaried official? It is a pity that so few employers take an interest in their men in this respect, for the choice of a hobby on the part of the worker is often indicative of character and efficiency and a desire to excell. Such a change of occupation may prevent the industrial fatigue that is aggravated by idleness and self-commiseration.

Few workers whose tasks occupy but eight hours per day should complain of industrial fatigue. The mechanization of labor is not altogether undesirable, for the monotony of motion involved is often unconscious; it is unlike the monotony of repetitive mental reasoning, which is far more tiring.

Modern industrial conditions are favorable to the worker. His attitude depends almost entirely on what he does in his spare time. So long as libraries are empty of readers, so long as ideas and impressions remain unrecorded and unpublished, so long as gardens remain uncared for, few other than the overworked multi-billionaire should complain of industrial fatigue.

A Shear-Zone and Sheer Nonsense

By T. A. Rickard

A FRIEND at Hyder, in Alaska, has sent me a page of the 'Sitka Sun' containing sundry geologic and economic definitions that ought to be interesting to those engaged in the gainful pursuit of mining. The Alaskan scribe spells it "sheer zone", and thinks apparently that it is a zone that is plumb or perpendicular, for that is the meaning of 'sheer' in such a context. The technical term with which he is struggling is 'shear-zone', a zone of rock that has been sheared or cut, and therefore crushed or brecciated. Such a portion of the earth's crust is supposed to be favorable to the presence of ore because the loose texture and fracturing of the rock offer facilities for the circulation of mineral solutions. The editor at Sitka says: "A sheer zone is a mineral deposit, contained in a slate or mineral belt". Thus it is said to be a mineral deposit in a mineral belt, which is confusing. On the other hand, slate is not the only rock capable of being sheared, for such a geologic structure is not limited to any kind of formation, although naturally it is more likely to be developed in a fissile rock than in one that is crystalline, such as granite. "A mineral belt", says our authority in the North, "can be, as in the Sitka mining district, 20 miles in width and 150 miles in extent of slate and diorite". So, it appears, diorite also can be subject to the same structural change. Probably he is thinking that the fissile slate is particularly likely to be sheared near its contact with the diorite. That is correct; because the intrusion of an eruptive may produce a line of weakness along which movement is probable. Next we are told that "a sheer zone can appear every few feet and it is not necessary that every sheer zone should pay". Which being interpreted means that conditions favorable to the deposition of ore do not always connote the existence of ore, because other factors besides kindly structural relations are needed to produce an ore deposit, and of these the chief is the passage or circulation of solutions sufficiently rich to precipitate ore and the presence of a precipitant that will induce the localization of valuable mineral.

Let us proceed to the next statement: "There are several different kinds of sheer zones, one of which is termed a true sheer zone, that can be traced for long distances, sometimes 40 miles or a great deal less". To this we venture to add the remark that there are several kinds of nonsense, some of which are harmful. The use of "true" in this attempted definition is a survival from the days when "true" fissure-veins were supposed to be superior in richness to other lodes. It is true that a shear-zone is traceable for some distance, for one of its characteristics is continuity, which involves the idea of recognizable width and measurable length. 'Zone' comes from a Greek word meaning 'girdle'; likewise 'belt' means a cincture, something that goes around something, such as the encircling strip of leather worn round the waist. This zonal idea is not implicit in geology, for the 'zone' or 'belt' to which the miner refers in his description of ore deposits is a strip or definite width of rock of vertical extent marked by certain characteristics.

Obviously to say that a shear-zone can be "40 miles or a great deal less" means that it can be of almost any length; however, the idea of length and of narrowness in proportion to the length is implicit. A portion of rock one mile long by one mile wide would not be a zone; the width must be so much less than the length as to suggest the essential idea of a strip or comparatively narrow piece.

The writer says: "A false sheer zone has no extent, at times they run adjacent to a true sheer zone, starting at the true sheer zone, and running at an angle of 45 degrees with little or no extent. At times a false zone will run a mile". We suggest that, not being what it is supposed to be, it may run clear off the map. If "they run adjacent at an angle of 45°" and have "no extent", they must be phenomenal, which describes an appearance that one does not understand. They remind me of the proverb that asserts there may be such things as volant nonruminating artiodactyles but at the same time declares them to be very unlikely birds. "In some cases pay is found running very high in value, but as we mentioned, never to any extent". So he who runs may read; the pay and the zone both run, a mile or less—what does it matter? The pay does not run "to any extent". This is discouraging. Moreover, it is a libel on shear-zones, which have been known to constitute lodes of unusual extent, for instance, not far from Juneau—a mining centre with which the Sitka gentleman ought to be familiar, for it has superseded his own town as the capital of Alaska. Finally, we are informed that "a sheer zone is truly a filling in of a crevice in rock caused by the centrifugal motion of the earth and other causes". The comprehensiveness of the last phrase is worthy of the by-laws of a corporation; apparently it includes the explanation that is conspicuously absent in this pseudo-scientific rigmarole. The Alaskan writer, like his "false sheer zone", has "run a mile" from his facts, and now transforms a crushed area into a crevice that has been filled by a force of which he has no evidence save the prompting of his own lively imagination. Indeed, his geology reminds me of the Kingdom of Heaven, of which it is said that it came not by observation.

Shear-zones deserve considerate treatment, for they are among the most productive of lode-structures. Usually the movement that has made them is distributed over a multiplicity of small slips rather than any one easily distinguishable fault. A good type of such ore deposits is the multiple gold-quartz vein in the schist of Otago, in New Zealand; another is the sheeted phonolite of Cripple Creek, where rich lodes were formed by the precipitation of tellurides of the precious metals along systems of minute fractures in dikes that had undergone mechanical strain, and along their contact with the older rocks. Such zones of shearing are usually marked by mineralogical changes; for example, massive diabase will become hornblende-schist. Metamorphic minerals, such as garnet, are developed. In the diorite of the Treadwell lode, for instance, enrichment coincides with the replacement of the ferromagnesian silicates by gold-bearing pyrite, accompanied by albite and calcite. In short, a shear-zone, especially if associated with an intrusive igneous rock, is a likely place for ore.

DISCUSSION

The Problem of Depletion

Discussion Between Senators Underwood, Smoot and McCumber Shows Careful Distinction Between Cost and Value as Applied to Revenue Act of 1921

THE EDITOR:

Sir—In your issue of April 22 appeared a discussion of "The Problem of Depletion," by C. B. Holmes, in which an essential feature was the criticism of an allowance of depletion based on *value* of property on March 1, 1913 (in case of property acquired prior to that date) instead of adhering to a uniform basis of *cost*.

The communication voices an erroneous assumption that the use of the term "value" as of March 1, 1913, was a Congressional error in drafting the law, when what Congress really intended to say was not "value" but was "cost." The fact is that the use of the terms "cost" and "value" in the law is not due to any error or misconception of the terms, but represents a careful distinction, deliberately made. It is the same distinction which applies to the determination of gain or loss on all kinds of property. The basis of this distinction is clearly set forth in a discussion between Senators Underwood, Smoot, and McCumber, with reference to the proposed provisions of the Revenue Act of 1921, as reported on pages 6517 and 6518 of the *Congressional Record* for Sept. 28, 1921, in which the pertinent parts are as follows:

"Mr. Underwood. . . . When the original income tax law was passed, the question was raised as to where capital should stop and where accumulated dividends or profits should begin. In the original drafting of the first income tax after the passage of the constitutional amendment the original draft did not prescribe the time when accumulated capital should be fixed. It was an oversight, and when the matter was called to the attention of the Ways and Means Committee they went into further hearings and consideration of it and finally worked out this proposition, that the income-tax amendment to the Constitution became effective on the twenty-eighth day of February, 1913; that regardless of what academic views we may have entertained as to the right to levy an income tax before that time, the Supreme Court had declared an income-tax law unconstitutional, and therefore, no matter what our academic views might be, under the law for the Federal Government to levy taxes on incomes before that date was a violation of the Constitution and it could not be done.

"Therefore the committee which drafted the first bill adopted the first day of March, 1913, as the beginning of the time when incomes or profits could be treated as such for the purpose of taxation, holding that before that time the accumulated profits and dividends were treated as the body of the estate, as principal. I think that conclusion was correct. I think it was correct from a legal standpoint, because prior to that time you did not have a right to reach back and tax the income unless you divided it in proportion to population.

"Mr. Smoot. There is no change in that.

. . . . . .

"Mr. Underwood. . . . but if it is the intention of the committee, either as to accumulated dividends of corporations or as to the growth of the value of property, when it is distributed either through the means of the stockholder or the corporation itself, to reach back to levy a tax on accumulations which occurred before the first day of March, 1913, I think you are writing an unconstitutional bill.

. . . . . .

"Mr. McCumber. . . . The committee agree entirely with the Senator that all accumulations prior to March 1, 1913, become a part of the principal, a part of the invested capital, of the corporation, and there is no intention to take those profits which had accumulated at that time and bring them forward and levy a tax upon them as profits; but if the Senator had owned a piece of land which he had bought in 1910, and he sold it in 1920, while we do not tax him on the difference between the 1910 price and the 1920 price for which he sold the property, we do tax him on the profit, measuring the 1920 sale price with the March 1, 1913, value. That measures his profits.

"Mr. Underwood. If that is all the bill does, I have no complaint; but I am not sure that that is all it does.

"Mr. McCumber. Let me carry it further. If, instead of purchasing a tract of land, the Senator had purchased stock in a corporation in 1910, and there were accumulations up to March 1, 1913, then whatever the property was worth in 1913 became, as the Senator has suggested, his capital; it belonged to him. If he sold that property in 1920, or disposed of any part of it, he was therefore disposing of a part of his capital, because it was treated as capital, and if he made a profit over and above what that part of the capital was worth on March 1, 1913, when he sold it in 1920, we simply tax the profits of the sale; not levying a tax on profits, but a tax upon the sale of his capital, of the thing itself, not of the profits arising from the thing. That is what is intended. I do not know that I agree even with that as a good policy, but that is really the only point that is involved, I think, in the amendment.

"Mr. Underwood. Let me ask the Senator another question, because I want to understand this matter. From his statement I understand him to say that the bill as reported by the committee does not tax any of the accumulated profits which were embraced as capital before March 1, 1913, in any event. Is that true?

"Mr. McCumber. No; it taxes simply the profit on a man's holdings, and that which he had accumulated prior to 1913 is a part of his holdings, a part of his capital. It is worth so much. If he does not sell it, of course there is no profit, and it cannot be taxed; but if he sells it in 1920, the difference between the 1913 price and the 1920 price, if there is a profit, is made taxable, as it is a sale of the corpus itself.

"Mr. Underwood. . . . I do hope, however, that if the Senator's committee mean what he says they mean, and what their report says they mean, they will put a proviso in those paragraphs distinctly saying that these paragraphs shall not be construed to tax accumulations or profits accruing prior to the first of March, 1913. If he will say that, that will end it.

. . . . . .

"Mr. McCumber. There is no doubt it should be made clear, if it is not clear now.

. . . . . .

"Mr. Underwood. As a matter of fact, a number of years ago we agreed in conference on this proposition. I think it will prevent future lawsuits and future differences if the Finance Committee will propose a simple amendment, declaring that nothing in this act shall be construed as warranting a construction that the bill taxes accumulated profits or dividends accruing prior to the first day of March, 1913."

During all this discussion the only question raised was as to whether the wording of the law made entirely clear what all the Senators agreed was its intention.

All the above reproduced discussion relates to the general proposition of the basis to be used in determination of taxable gain in the case of property owned prior to March 1, 1913. Manifestly, there was no Congressional error involved in drafting the depletion section of the law, so that in the case of properties acquired prior to March 1, 1913, the value of the property at that date (rather than its cost) would be used.

Perhaps in some cases this does introduce a further complication, but my own experience is that it is far less difficult to determine the fair value of the property as of March 1, 1913, than it is to go back perhaps twenty to fifty years to determine what was the cost of the mining property at the date it was acquired. I believe the Revenue Department officials would agree that they had more difficulty in determining the cost of property to be used for purposes of invested capital than they had in determining the fair value of the property on March 1, 1913, to be used for depletion.

In a further communication, in your issue of May 27, regarding "Inconsistencies in Mine Depletion Acts," Mr. Holmes again assumes that Congress has not been successful in enacting into law what it intended should be the basis for depletion. A review of the depletion provisions as they appear in the revenue acts of 1916, of 1918, and of 1921 (as they were enacted; not as they are paraphrased by Mr. Holmes) will show that they are all intended to reflect the mature, deliberate conclusion of Congress, as set forth in the discussion quoted above; viz., that, in the case of property acquired prior to March, 1913, the *value* of the property at that date, rather than its *cost*, should be the basis for determination of taxable gain.

H. B. FERNALD.

New York.

Using the Katathermometer in Mines*

In connection with the co-operative metal-mine dust and ventilation investigations of the U. S. Bureau of Mines and the U. S. Public Health Service, some underground data have been obtained with intent to ascertain the adaptability of the katathermometer for determining the comfort of working places in mines. This preliminary study indicates that the instrument will probably be useful for making routine determinations of comfort conditions in the mines of the country, and that it may also prove an important accessory for investigative work on problems in ventilation and kindred subjects, in both coal and metal mines, although the instrument should probably be altered somewhat for maximum utility under the varied conditions in the mines of the United States.

The katathermometer is an instrument contrived by Dr. Leonard Hill, an eminent English physiologist, and its various features have been fully described by him in his book entitled "The Science of Ventilation and Open Air Treatment." He made exhaustive experiments, and concluded that the rate of cooling of the human body was the controlling factor in determining comfort or discomfort, and then set out to make an instrument that would measure this rate of cooling. The resulting instrument, the katathermometer, measures its own rate of cooling when its temperature approximates that of the human body.

*Abstracted from "Serial 2,355," U. S. Bureau of Mines, *Reports of Investigations.*

Metallurgical Progress on the Rand

The New State Areas Plant

The new plant of the New State Areas Co. on the Witwatersrand embodies ideas quite different from standard practice in that part of the world. It will crush ore without the employment of gravity stamps and without amalgamation. Construction began in January. From the *South African Mining and Engineering Journal* we gather the following details of operation:

The plant will have a capacity of 50,000 tons per month, and all sliming of the ore will be effected by means of a combination of crushers and tube mills. Gravity stamps and amalgamation plates will be entirely eliminated, and it is expected that there will be not only a large saving in capital expenditure, but that working costs will be substantially reduced and the value of the ultimate residues will be certainly no higher than is the value of residues that are produced in the older plants.

The ore from the feed bins will pass into a large receiving bin capable of holding 1,300 long tons. From there the ore will be transported and sorted on three sorting belts to the crushers. There will be three sets of crushers, of which two will be in operation and one will be in reserve. In the primary set, Hadfield's jaw crushers will reduce the ore to 2¼-in. cubes. In the secondary set, there will be horizontal disk crushers, which will reduce the rock passing through it to a maximum size of 1 in.

The whole of the crusher plant of the New State Areas equipment is being supplied by Hadfield's, Ltd. From the secondary crushers a main conveyor will then take the rock to the tube-mill bins. There will be thirteen tube mills, each 6½ x 20 ft. The standard size of tube mills on the Rand is 5½ x 22 ft., so that the New State Areas mills will be substantially larger than others on the Reef. Each tube mill will have a Dorr classifier and each will be operated by a 250-hp. motor.

The pulp from the tube mills will be pumped by 8-in. main slime pumps to the slime collectors. Ore will enter the water circuit in the crushers, and as soon as the pulp reaches the tube mills it will come into the cyanide circuit and will be ground in a cyanide solution. The slime collectors will be of a new type. They will be square concrete tanks. Eight of these tanks are to be erected. The overflow from them will go to three tanks of the same type. The slimes will pass on to the Brown agitator tanks, which are specially constructed for the purpose.

Instead of the standard type of Brown tank, which is 15 x 45 ft., the agitator tanks at the New State Areas will be 22 x 45 ft., thus giving double capacity in one tank. The slime from the Brown tanks will next pass to a pulp storage tank and from there will gravitate to a Butters filter plant of 600 leaves. The solution from the Butters filter will pass through classifiers in the usual way to a de-aëration plant and from this to the Merrill zinc-dust precipitation presses, the solution thereafter being returned to a large capacity storage tank.

The plant will have an initial capacity of 600,000 tons per annum, but will be capable of considerable expansion and can be duplicated for a comparatively small outlay.

The Mayo District in Yukon Territory

Three Strong Companies Now Operating in New Silver-Lead Region—Development Confined to Keno Hill Area—Mineralization Found Over Sixty-Mile Stretch —Field Remote and Means of Communication Uncertain

By Charles Francis Williams
Photographs by courtesy of Keno Hill, Ltd.

RAPID IMPOVERISHMENT of known gold placer deposits in the Yukon River basin has spurred the "quartz" prospectors in the North to greater effort, and several notable discoveries have been made. The finding of veins containing argentiferous galena on Keno Hill, in the Mayo district, in 1919, is probably the most important discovery made in the territory in recent years, and extensive prospecting by organized companies and private claim owners has since uncovered shipping ore in quantity at widely scattered points in the district.

The Mayo district lies 125 miles due east of the town of Dawson between the headwaters of the McQuesten and Stewart rivers and 180 miles from the mouth of the latter. The Stewart River, together with the Yukon, forms the main artery of transportation during the summer months. Winter mail trails are maintained by the Canadian government. These connect the camp with Dawson and with the Overland trail at Minto, on the Yukon.

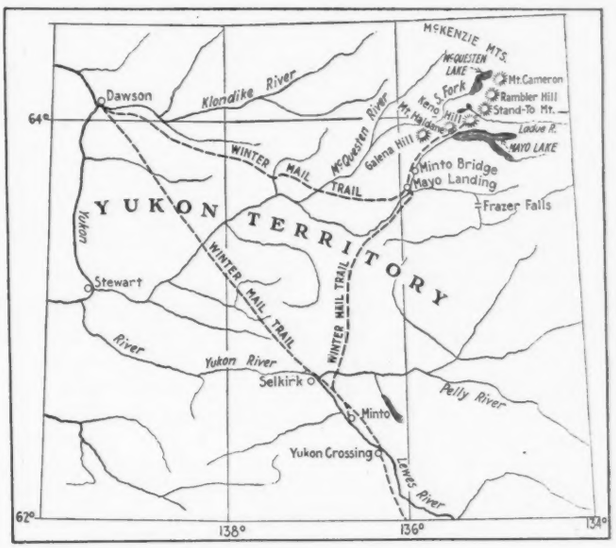
Mining Done in Winter, Prospecting and Development in Summer

Underground development and surface prospecting has, in the past, been carried on during the short summer season. The greater part of the ore is mined during the winter, from Nov. 1 to April 15, when the forty-two miles of road from the mines to Mayo Landing on the Stewart River are in condition for heavy

Freight on beach at Mayo Landing, brought on first boat from Dawson, May 30, 1921. Front Street in background

sled traffic. The sacked ore is skidded down to Keno City at the foot of the hill in rawhides, and transferred to heavy sleds of ten tons' capacity for transportation to Mayo Landing, where the ore is stacked on the river bank. When the ice goes out, late in May, 500-ton barges carry the ore down to the Yukon, where it is reloaded on barges of 5,000 tons' capacity for St. Michael, at the mouth. Here it is transshipped in ocean bottoms destined for smelters on the west coast, a total distance of about 5,000 miles, at a cost of about $25 a ton for water transportation.

Ore and supplies are hauled over the road from the river to the mines at a contract price of about $30 a ton during the winter. The total cost of mining,



Map of Mayo district, Yukon Territory

transportation, and smelting is said to be under $100 a ton. One company is figuring on tractor haulage for next year, and railway transportation is under consideration. It is not improbable that a narrow-gage road will be built connecting the camp with the White Pass and Yukon Route at White Horse, or with a point on the Stewart River near Mayo Landing.

Silver Discovered Over Sixty-Mile Stretch

The Mayo district lies fifty miles south of the height of land in the Yukon plateau area which has an average inter-stream elevation of about 5,500 ft. The plateau is composed largely of Pre-Cambrian schists and quartzites, deeply eroded by streams and rounded by glaciation.

Limited prospecting has uncovered silver ores on six isolated hills trending in a northeasterly direction from Mayo Landing—namely, Mount Haldane, Galena Hill, Keno Hill, Stand-To Mountain, Rambler Hill, and Mount Cameron—a distance of about sixty miles. This region is dissected by a number of lake-fed streams, but these are, with possibly one exception, unfavorable for hydro-electric power development.

Keno Hill, because of the extensive development and proved value of its ore deposits, will be described in greater detail, though further prospecting will prob-

ably uncover important orebodies elsewhere in the district. This hill has an elevation of 6,346 ft. Its three-mile crest is broken by five peaks known as Keno, Minto, Monument, Caribou, and Beauvette hills. The timber line conforms fairly close to the 5,000-ft. contour, and a considerable share of the properties undergoing extensive development lie above this line. Water is scarce on the summit during the summer, but may be hauled from springs just below the timber line. During the winter, snow water is used for domestic purposes. The northern face of the hill is precipitous, and has a stepped appearance, due to the outcropping of alternate hard and soft formations. Seven gulches drain the hill into tributaries of the Ladue and Stewart rivers. These gulches are, as a general rule, surficial expressions of fissures.

7,000 Ft. of Sediments Exposed on Keno Hill

The country rock of the area is everywhere mantled by glacial drift, slide rock, and frost-shattered outcrops, held in place by ice and moss, and making it difficult to prospect. Fortunately, the galena and manganese float does not travel far, and often is found turned up by wagon wheels or under an uprooted tree stump. More than 7,000 stratigraphic feet of metamorphosed sediments are exposed on Keno Hill. The beds consist of banded blue and white gneissoid quartzites and schists. The schists are differentiated by predominance of mica, quartz, graphite, sericite, or hornblende. These beds strike in a general east and west direction and dip to the south at a decreasing angle of under 30 deg., but tilt abruptly near the crest forming the peaks. The basement is believed to be a granite batholith, from which dikes and sills and laccoliths of andesite, diorite, diabase and, occasionally, a felsitic rock grading from a rhyolite to a granite porphyry, have been intruded into the sediments. The diorite and diabase are largely altered to greenstone, which is intruded into the lower schist formations as sills and into the upper strata as laccoliths.

The basic intrusives are of different ages; both Pre-Cambrian and early Mesozoic eras are represented. These intrusives are believed to have a genetic relation to the different vein systems. The granitoid rocks are of small extent and cut across the structure in several places, indicating that they were the last intrusives in the area. There are three prominent horizons of quartzites. The upper bed and cap rock of the structure is over 2,000 ft. thick south of the hill; the lower bed is about 150 ft. thick, and the middle strata nearly 750 ft. The upper two are composed of alternating beds of schist and quartzite, and the lower one is frequently gneissoid.

Keno Hill Formations Show Two Vein Systems

Two distinct vein systems and several non-related veins have been found on Keno Hill. The oldest veins have an average strike of north 60 deg. east and dip 70 to 80 deg. to the southeast. They tend to parallel the strike of the formations and are fault fissures of large throw. The mineralization is arsenopyrite, siderite, limonite, manganese, pyrite, sphalerite, and some galena and tetrahedrite carrying the silver. The gangue is quartz. Gold assays are not uncommon.

The younger veins have a strike that varies from north 40 deg. east to north, and dip 60 to 75 deg. east. They intersect the older veins at an angle of about 70 deg., and are fault fissures of little throw, cutting across the strike of the formations. These veins occur in groups to the north and south of the peaks, and are contemporaneous with the greenstone intrusives which produced the folding resulting in these peaks. The mineralization is manganese, limonite, galena, sphalerite, stibnite, calcite, freiburgite, and quartz, in a siderite gangue, with altered quartzite and greenstone in the vein matter. (Calcite in the younger veins and arsenopyrite and pyrite in the older veins seem to be the differentiating mineral.) Another type of the east-west vein has been found on the north slope. It contains little or no galena, but carries freiburgite with manganese and a little chalcopyrite. These veins have given high silver assays and contain malachite and azurite near the surface. The mineralization follows the greenstone-schist contact as far as developed.

The older fractures appear to have undergone two distinct phases of mineralization. The later fractures caused movement and spreading in the older veins, and in the earlier sporadic mineralization, consisting largely of quartz, manganese and a little arsenopyrite, the quartz was replaced in some places by galena. When the older fissures are intersected by the younger veins, high-grade galena, freiburgite, and associated minerals of the younger veins were introduced. Except for these points, the older fissures have not been proved to contain shipping ore under existing conditions, but with reduced costs of mining and transportation they may develop into the big tonnage producers of the camp.

Some of the richest oreshoots have been found in the upper portions of the greenstone and quartzites where the north-south faults intersect the east-west faults beneath a schist capping.

Silver as Sulphide and in Tetrahedrite

Silver occurs in all the galena in the form of an isomorphous sulphide and in tetrahedrite where the silver replaces the copper up to 30 per cent. Crystals of this freiburgite have also been observed in the galena. Considerable cerussite has been mined from the upper workings, but recent glaciation and rapid erosion, together with the absence of pyrite in quantity, mitigate against the possibility of extensive secondary enrichment, though a small amount of native and ruby silver was found at a depth of 200 ft. on a north-south vein. Recent prospecting of the east-west veins near the south base of the hill has uncovered a strong shoot of silver-galena assaying just under the present shipping grade. The vein lies between banded quartzite and schist walls with a siderite-manganese vein filling, and may indicate that the higher grade orebodies are associated only with the late north-south veins. The oreshoots developed in the short north-south veins near the summit, however, have not been proved to be persistent in depth, except in the vicinity of the intersection point with east-west veins, and little ore has been developed below the 200-ft. level.

Extensive development work has been confined almost entirely to the Keno Hill area, where about 700 claims have been staked. The original stakers were placer miners with little knowledge of quartz prospecting, and they have, with few exceptions, been content to hold their ground by annual assessment work. This is unfortunate in that it has retarded the development of the district. The comprehensive exploration of the Keno Hill area is in the hands of three aggressive companies, which have optioned or purchased several groups of promising claims.

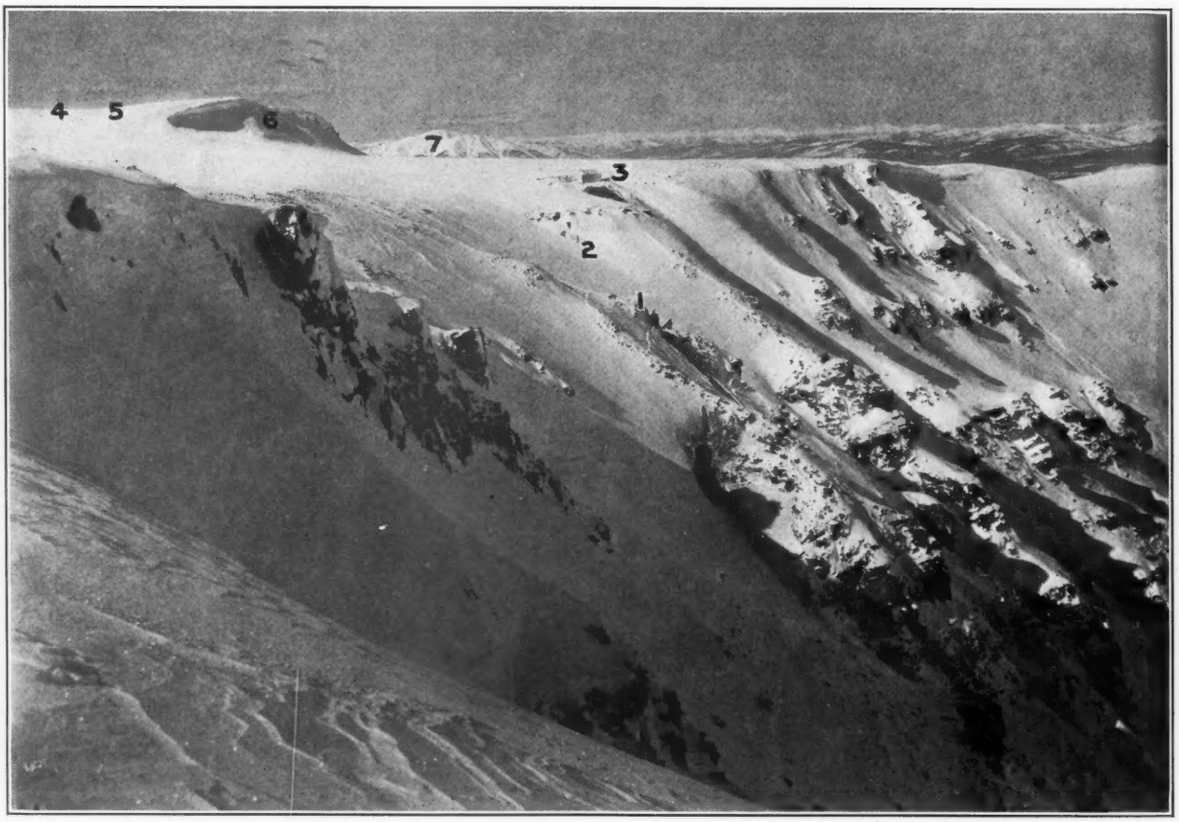
The Yukon Gold Co. was the first organization in

Views of the Keno Hill Region, Yukon Territory

McQuesten Valley and Ogilvie Range seen from Keno Hill. 1—*McQuesten Lake.* 2—*Ladue Lake*

Looking east across head of Silver Basin, Keno Hill. 1—*Caribou Workings.* 2—*Mount Patterson*

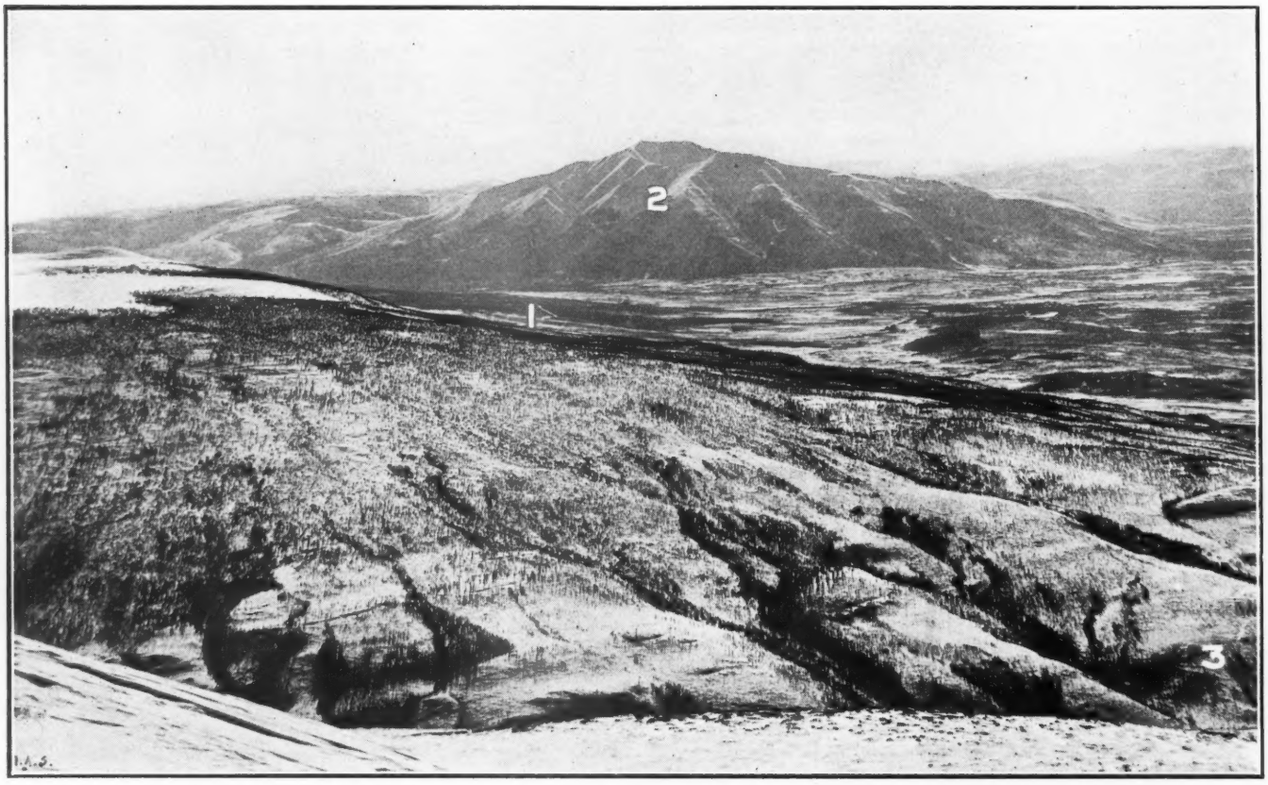
Bluff 700 ft. high on Keno Hill, where several workings of Keno Hill, Ltd., are located. Cross indicates discovery point



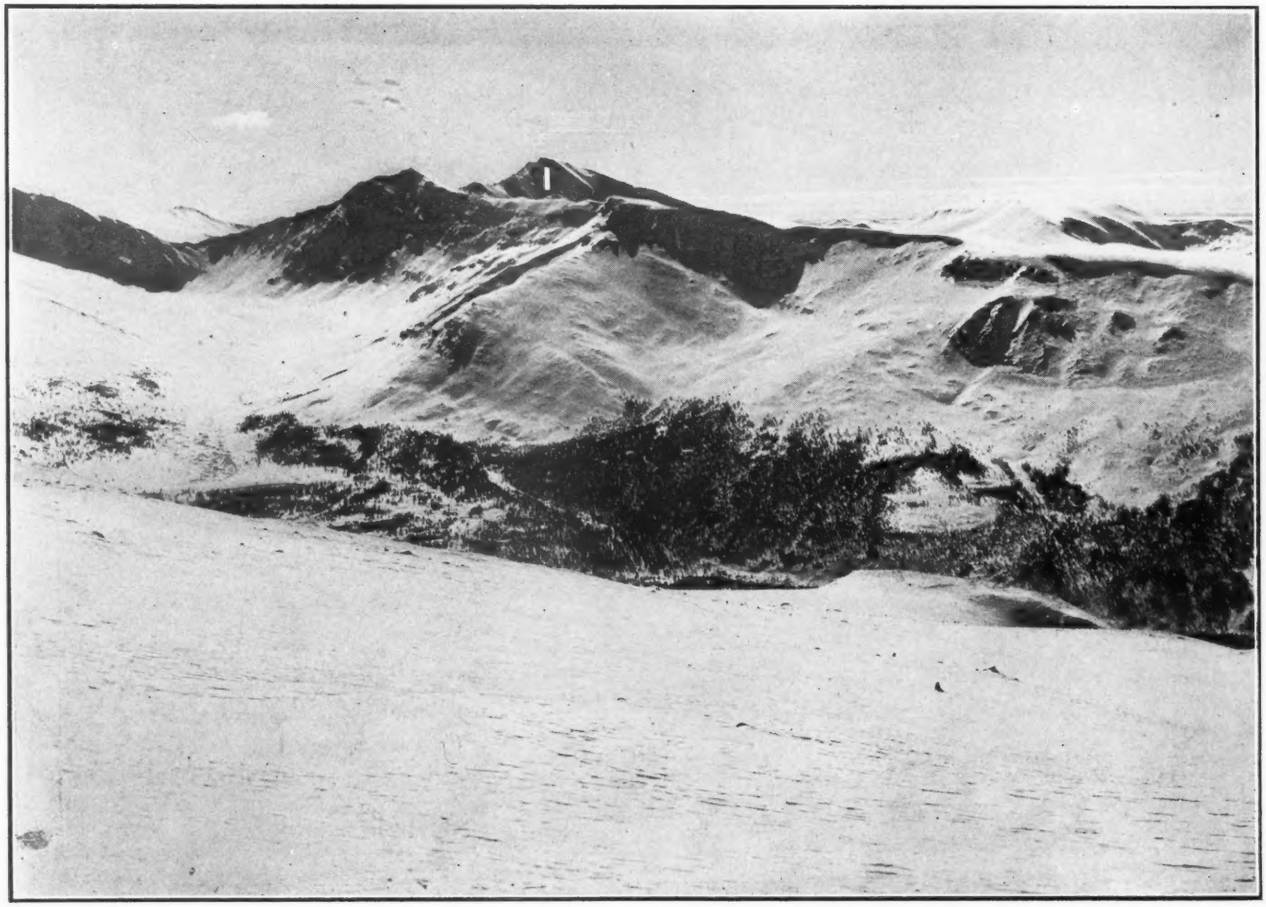
Same bluff as shown above. 1, 2, 3, 4, 5—Workings of Keno Hill, Ltd. 6—Keno Hill proper. 7—Lookout Mountain. Level stretch at top of bluff is Keno Plain

Looking east from point on Keno vein

Part of Mount Cameron (1) *and Mount Patterson* (2). *Seen from bluff at Keno Hill*



1—Silver King Mine, visible from the northwest end of Keno Hill. 2—Lookout Mountain, eighteen miles away. 3—Crystal Creek



Looking southeast from Keno Hill. 1—Mount Hinton in background

the field (September, 1919), and secured options on ten claims and several fractions known locally as the "central group." These claims are now being developed by the Keno Hill, Ltd., the operating subsidiary. The main camp is situated just under the west summit at an elevation of 5,800 ft. above sea level overlooking the steep slope of Faro Gulch. The buildings are of frame construction, and include a bunk house, mess house, office and assay laboratory, hoist and compressor house, blacksmith and machine shop, warehouse, bins, and a sorting and sacking plant. Both gasoline and electric power are available. The bucket used for hoisting in the 235-ft. inclined shaft is carried in an overhead sling to the bins over the centrally placed sacking plant. The hoisting capacity is about forty tons per day. Power is transmitted to the mines from the company's 100-kw. steam power plant at Discovery, over a five-mile high-tension line. The company controls the water power rights at Frazer Falls, on the Stewart River.

The development work consists of nearly 3,000 ft. of shafts, tunnels, and open cuts on the twelve veins exposed on this group, eight of which have produced ore. These veins vary from 6 in. to 5 ft. in width. A second group of claims known as Friendship Camp, and lying just below the timber line on the west slope, has been the scene of active prospecting lately. The vein is remarkably persistent and well mineralized with galena. Water was struck in two of the shafts at an average depth of 50 ft., and operations will be held up pending the arrival of pumping equipment. This company has expended approximately half a million dollars to date and shipped 2,150 tons (net) of ore assaying 196.7 oz. of silver and 60 per cent lead. About twenty-five men are employed, and the 1922 shipment is expected to be about 3,000 tons having a slightly higher silver content than the first shipment. This tonnage will be mined almost entirely from the No. 9 vein. Warren McFarland is superintendent and Jack Stewart is mine foreman.

Bradley Interests Have Modern Plant

The F. W. Bradley interests, represented by their Treadwell geologist, Livingston Wernecke, came in in July, 1921, and secured options on fifteen claims. An aggressive policy was initiated and a well-built and modernly equipped mine plant was put in operation within a few weeks on the claims adjoining the Friendship Camp on the north. The vein is believed to be a continuation of the Friendship Camp vein, and has been uncovered for several hundred feet. It is from 3 to 14 ft. wide at the outcrop.

The mineralization is galena and some freiburgite in quartz and siderite gangue. Two shafts are being sunk to a depth of 300 ft., and four connecting levels will be driven to determine the nature and size of the oreshoots. Steam hoisting and compressor equipment have been installed. About 250 tons of ore, which will be recovered from the development work, will be shipped this year. About twenty-five men are employed. W. B. Hargraves is superintendent and J. H. Jones and Dan McDonald are the foremen.

Slate Creek Company Entered Recently

The Slate Creek Mining Co. is another recent entry into the Keno Hill field. This company has taken options on nine claims, and will continue active prospecting all winter. A small lot of rich freiburgite ore said to assay over 1,000 oz. has been mined on the Lucky Queen group, at the head of Gambler Gulch. A 400-ft. shaft is being sunk on the Walsh group, just above the town of Keno City, and a 1,000-ft. haulage tunnel is being driven from the main camp on Lighting Creek to connect with this shaft. The company has bonded several promising claims on the north slope between Faro and Gambler gulches at an elevation of about 4,700 ft., and has a crew engaged in opening up this section, the scene of several rich strikes. J. Moore **Elmer is manager and E. E. Bussey** is in charge of the company's operations.

Silver King Only Example of Secondary Enrichment

The oldest producer in the district is the Silver King mine, on Galena Hill. This mine was owned and operated by Tom Aitkin in 1914-15, and is reported to have produced ore valued at $400,000 from two oreshoots near the surface. The largest was 8 ft. wide and 150 ft. long. The vein dips 70 deg. to the west and has a quartz foot wall and a schist hanging wall. It is the only example of secondary enrichment of economic importance so far uncovered in the district. A shaft was sunk to a depth of 250 ft., but little development work has been done on the vein. The ore was galena, argentite, and pyrargyrite in a barite gangue. The first shipment, of sixty tons, assayed 452 oz. of silver and 46 per cent lead. The second shipment, of 1,180 tons, assayed $3 gold, 270 oz. silver, and 31 per cent lead. At the time this property was operating it was believed to be an isolated occurrence of silver ore.

Lookout and Shamrock Only Other Shippers

The Lookout mine, on Mount Haldane, was operated by a local company known as the Lookout Silver Lead Mining Co., Ltd. A strong irregular vein in quartzite was opened up at an elevation of 3,500 ft. and prospected by 1,000 ft. of shafts and tunnels. The pumping equipment failed to handle the water, and the mine was closed down after shipping twenty-seven tons of hand-sorted silver-lead carbonate ore to the Trail smelter two years ago. The vein filling is quartz, manganite, pyrolusite, limonite, cerussite, and galena.

The ore is of a disseminated character and will require milling before shipment. The smelter returns on the shipment were as follows: 0.01 oz. gold; 95.60 oz. silver; 0.40 per cent moisture; 59.40 per cent lead; 0.70 per cent zinc; 4.70 per cent sulphur; 12 per cent silica; 4 per cent iron; 1.10 per cent cobalt oxide; and 1.20 per cent magnesium oxide.

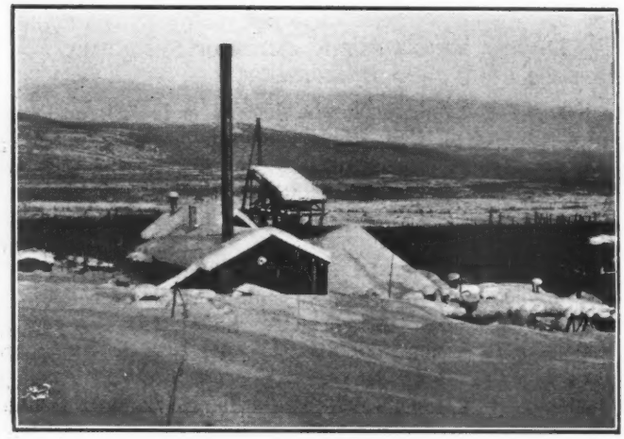
The Shamrock group, at the head of Ericksen Gulch, on Keno Hill, has shipped three tons, said to have averaged 200 oz. per ton. No other shipments are known. A number of outlying properties have good showings in the surface trenches and shallow shafts. The Silver Basin group, on the north side of Keno Hill, is particularly promising, and will probably be prospected extensively this year.

The more distant properties on Rambler Hill, where workings at an elevation of 4,500 ft. have uncovered a wide vein of oxidized ore said to assay 50 to 135 oz. of silver and 65 per cent lead. At Stand-To Mountain and Mount Cameron, where sheeted zones about 50 ft. wide carrying galena have been found near the timber line, the surface has hardly been scratched. Galena float brought in assayed about 100 oz. silver.

The high coast range makes the climate pleasant

most of the year. The summers are dry and warm and the winters are cold and have a comparatively light fall of snow. The thermometer seldom registers below 30 deg. in the lowland areas of the district and remains at this point only for short periods, and on the upper reaches of Keno Hill the temperature is well above zero when it has fallen to 60 deg. below in Dawson.

A sawmill is in operation at Mayo Landing having a capacity of 20,000 ft. of lumber a day. Another mill



Silver King Mine, looking toward McQuesten Lake

is being built at the mouth of Duncan Creek, eleven miles south of Keno City. Lumber costs about $160 a thousand delivered at the foot of the hill.

The lower slopes of Keno Hill are well forested. The timber is spruce and is suitable for cabin logs and mine timbers. Fire wood is plentiful at $10 a cord. The nearest operating coal mine is at Tantalus Butte, on the Yukon River, 150 miles above Dawson and 250 miles from Mayo Landing by water. This mine produces about 2,000 tons a season for local consumption. The analysis of this coal is 51.84 per cent fixed carbon; 41.84 per cent volatile matter; and 2.69 per cent ash.

Means of Communication Uncertain

Communication with the outside world is slow and uncertain. Letters addressed to the United States require three to four months for answer in the winter and at least two months in summer. Telephone service has been established between the mines and Mayo Landing, but the Government line on the Yukon connecting White Horse with Dawson has not been tapped.

The freight rate from Vancouver to Mayo Landing is $83 a ton during the summer. From this point 10c. a lb. is charged to Keno City at the foot of the hill and an additional 5c. to the summit via the wagon road.

Long Life of Camp Not Yet in Evidence

Sufficient development work has been done to guarantee the continued production of high-grade ore for some time. Nothing has yet been uncovered, however, to assure sustained production for a long period of years.

The prevailing wage in the district is $5 for an eight-hour day, with board and lodging. There are about 600 people in the district, but there is a shortage of hard-rock miners at all times, and men are exceedingly scarce during the summer, when the hydraulic operations around Dawson and the prospecting fever take their quotas from the mines.

Dr. W. E. Cockfield, of the Canadian Geological Survey, has spent the last three summers in the district, in preparation of a monograph on the silver-lead deposits. With his assistants he has played an important part in the development of the camp; ready at all times to give sapient instruction and advice to prospectors or to survey roads through the subarctic forests when no territorial funds were available, thus exemplifying the true scientific spirit in the best interests of the Survey.

Miami Copper's Costs per Ton Decline

A lucid and valuable report of operations of the Miami Copper Co. for 1921 states that an average of less than five mill sections was operated in that period. The results of these operations were as follows:

		Copper Content, Per Cent
Ore milled, tons	1,868,757	1.758
Concentrate produced, tons	73,123	38.372
Copper in concentrate, lb.		56,117,827
Copper per ton of ore, lb.		30.03
Mill extraction, per cent		85.37

The cost of milling ore to the point of concentrate on board cars is as follows:

Direct crushing expense	$0.35983
Direct concentrating expense	.19784
Tailing and concentrate handling	.06095
Water for concentrating	.05825
Miscellaneous expense	.02777
Total	$0.70464

The total milling cost dropped 12c. per ton as compared with the previous year, despite a higher power cost, the reduction being due principally to lower labor costs and a reduction in the amount of experimental work.

The metallurgical results in the mill were good, the copper extraction being 85.367 per cent and the sulphide copper in the mill general tailing being 0.132 per cent. These are the best yearly figures which have been obtained since the beginning of operations in 1911.

The filling of the canyon in front of the mill with tailing was completed in August, and furnishes a much-needed yard space to the extent of 3.52 acres.

During the last month of the year the new tailing elevating plant was completed and put in operation. This consists of a battery of six Wilfley sand pumps discharging through 1,260 ft. of 18-in. wood-stave pipe line against a total head of 37 ft.

The smelter returns of refined copper on the concentrate shipped amounted to 53,311,941 lb., and the cost of this copper in concentrate on board cars at Miami was as follows:

	Per Ton Ore	Per Lb. Copper
Mining	$1.14905	$0.04028
Milling	.70464	.02470
General	.38384	.01347
Total	$2.23753	$0.0745

The figures show a decrease in all departments as compared with the records for the previous year, the total reduction amounting to 28c. per ton. The reduction in the cost of copper, however, is less than ½c. per lb., due to the fact that the copper content per ton of ore is less than in the previous year, which is attributable, as previously explained, largely to interference with mining operations by the delay in the delivery of the hoisting equipment for No. 5 shaft.

The Geological Department of Phelps Dodge Corporation at Tyrone, N. M.

Organization of the Work—Methods of Obtaining and Recording Data—Assay Maps Are in Charge of the Geological Department

By Djevad Eyoub

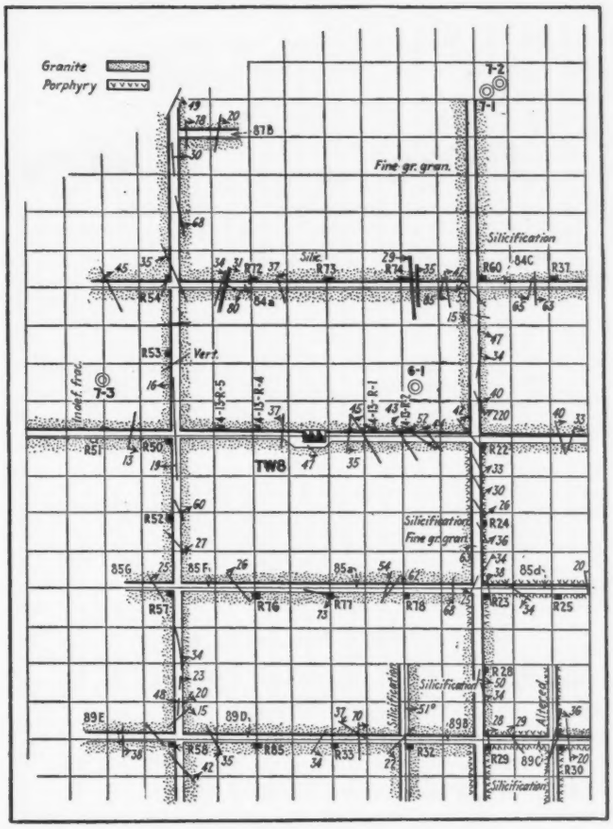
ONE of the interesting features of the operations of the Phelps Dodge Corporation at its Burro Mountain mines, at Tyrone, in New Mexico, is the work done by its geological department, consisting of a chief and three assistants. The chief geologist, besides being in direct charge of the department, supervises the work done in the chemical and sampling departments, though the former, from many standpoints, may be considered autonomous and solely responsible to the general manager.

The mines were divided into two main groups at the time the company took over the property from the original owners, and despite the large amount of development work subsequently done, these two divisions have been kept distinct. The mines in No. 1 division are reached by a tunnel; those in the other division, known as No. 3, are reached by various shafts. One assistant geologist is assigned to each division; he does the underground as well as the office work. This method of having the same man do all the work for a division, instead of having one man confine his work to the mines and another to the office, is believed to be more satisfactory than a distinct division of the respective activities. The remaining member of the department looks after the sampling and the log of the churn drills, and, whenever he has extra time at his disposal, as when the drills are idle, he helps the others, who are invariably unusually busy at the beginning of the month.

The division geologist ordinarily begins his rounds of the mine about the middle of the month. He goes to all the drifts, raises, and stopes where work is being done. Probably ore is being taken from a dozen or more stopes, but, except in rare instances, he goes only to square-set and slice stopes. His underground equipment includes a 100-ft. cloth tape, a leather-covered note-book, a 6-in. celluloid scale with centimeter divisions, which serves also as a protractor; various large-scale maps of the individual workings, and a large map covering the entire division.

On reaching the working place, the geologist identifies a survey station to which he ties his work. Beginning from the point where the geology has been noted last, the worker proceeds to note the character of the rock and the nature of the mineralization. Slips, whether important enough to be classed as vein or not, are noted by taking the distance on both sides of the drifts. Dip and strike are noted, and the size of the slip. In working the geology of a raise the distances are taken from the rail level, and preferably all four faces are projected on cards, 3 x 5 in., as indicated in the accompanying sketch. It is sufficient to visit a "raw" raise at the time of its completion. In softer ground where cribbing is required the geologist should keep the working constantly in mind and examine it after every other round if possible. Though development raises may be overlooked occasionally, the exploratory work should never be neglected.

On the raise cards the geologist notes the kind and character of the rock, the important minerals present, and the location of the more prominent slips. Not infrequently the geologist may experience difficulty in determining the nature of the rock. Whenever he is not sure he takes a specimen with him, so that he may



Portion of mine map on which geology is indicated

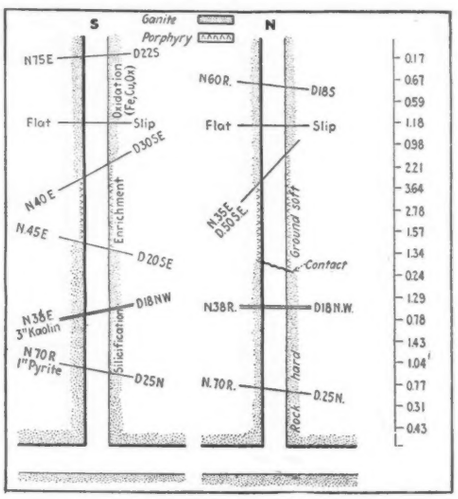
study it in the office, where he has better facilities. After being in a mine several years the nature of the different rocks becomes so fixed in the worker's mind that at sight of a raw drift he is able to identify the rock from the way it has broken.

The last few days of the month are spent in a rapid survey of the workings, so as to make the report rendered at the beginning of the month complete. The engineering department prepares a list of workings, the sampling department adds the average assays for the advance made during the month, and the geological department records the kind of rock through which the advance has been made, including a notation as to whether the rock is mineralized or not. The latter fact is indicated, of course, by the assays, but the geologist's note is useful in serving as a rough check on the sampling.

At the office are three sets of maps, each traced from the original in the engineering department, the geologist

keeping the three sets up to date. These consist of geological, "pick-assaying," and "channel-assaying" sheets. A scale of 1 in. to 50 ft. is used. The geologist records pyritic slips in red ink; mineralized slips, in green; "pug" slips, in blue; and the slips where marked oxidation is observed, in brown. Other information, such as the presence of certain minerals, is noted in black.

The next set to be brought up to date is the pick-assay sheets. The sampling department sends a statement covering the pick assays taken after each round from drift and raise. Whereas the drift assays are recorded on the standard sheets, the raise assays are kept in a loose-leaf book, where the channel as well as the pick assays are written side by side. The pages are numbered and entered in the index, so that by referring to the section of the mine where any raise is situated, and noting the number—they are given in



Typical raise-sketch, showing the method of recording the geology

consecutive order—the assays on any particular raise are easily determined at a future time.

Channel assays came at a later date; but by the time the geological and pick-assay sheets are finished, they begin to arrive from the assay office. These are recorded in similar fashion, but are checked with the compiled list as sent from the sampling department.

When the three sets of maps are completed, the work on sections begins. Vertical sections of all stopes are made at intervals, the frequency of which varies. Some of the more important stopes have geological vertical sections as well as another set of assay sections made along the opposite co-ordinate. The sections are generally at 25- or 30-ft. intervals. The average of the assays for these distances is recorded on the section. It is good practice to color the part of a drift where the assays are above the standard adopted for a part of the mine. This affords a ready way for visualizing the degree of mineralization in any particular level.

After recording the geology, completing the two sets of assay sheets, and then transcribing the assays onto the sections, the work of "bringing up" the models begins. These are copies on rectangular celluloid sheets of the work already done on the standard geological sheets. The sheets can be superimposed, and the relationship of the levels noted. These models help greatly in giving a correct idea of the geology of the mine. Attention might be called to the fact that in transcribing the geological data onto the geological vertical sections, dip charts must be used; this makes a great difference, especially when the strike forms an acute angle with the direction of the co-ordinate on which the section is being made. The office work is usually completed about the middle of the month; the same cycle is then repeated.

Twice a year the geologist is particularly busy, making the semiannual ore-reserve estimates. The details of this work form a subject by itself, but it may be mentioned that the superintendent and the chief geologist, after long discussions, in which the foremen may be consulted, and, not infrequently, the judgment and the decision of the general manager are sought, mark certain limiting lines on the level and stope assay maps.

Each stope has its "oxide factor," based partly on what the stope in question has already shown in mill returns and partly on the opinion of the chief geologist and the superintendent. All the assays within this boundary are averaged, both on the pick map and the channel map. Sometimes the boundaries are drawn originally on the level sheets, and at other times on the sections, according to the procedure to which the particular orebody best lends itself. In either event the lines are transferred from level sheets to the sections, or vice versa. Thus, when a colossal amount of adding-machine work is done, there will be two pick and two channel averages for the same orebody. Channels are weighed against the pick assays and a final average is attained. By the use of a planimeter the areas are determined. From the gross tonnage thus obtained the total ore mined is subtracted, and the result is indicated as the ore reserve of that particular orebody. There are a number of orebodies where only churn-drill information is available. The estimates for these areas are made by the use of the pyramidal formula. Estimates thus made are entitled to high rating, though they are probably not as accurate as the estimates for the mine proper, where considerable work is done and more complete data regarding the nature of the deposit can naturally be obtained.

The member of the department who attends the churn drills spends a good part of the day at the scene of operations. These are often far apart, a fact which necessitates the use of a horse or an automobile in getting about. Samples are approximately $\frac{1}{4}$ of the total amount of sludge discharged from the hole. The drillers dry these samples on the fire, so that when the geologist arrives he has only to remove the dry samples from the pans and reduce them to a suitable size. The sample weighs 15 or 20 lb.; it is reduced to a size of about 2 lb. Another pan which has received the sludge from a total of probably 50 ft. is panned and the minerals present are noted. It is customary to take samples at 10-ft. intervals while the drill is passing through the oxidized zone and at 5 ft. after entering the sulphide zone. The geologist returns to the office at about 4 p.m., when he records in the log book the work done and the sample returns, along with the geological data obtained.

The geological department serves as the repository of the geologic and assay information; it is a source of constant and useful help to the superintendent and foremen. In a small mine such information may be kept in the manager's mind, but in bigger enterprises this is impossible, and the geological department, with its records and indexes, serves as an invaluable source of information for the officials.

Marketing of Soapstone*

Sold in Slabs and Blocks to a Limited Field of Manufacturers and Builders—Schuyler, Va., Is Chief Source of Supply—Deposit Must Be Large to Warrant Construction of Plant

By Raymond B. Ladoo
Mineral Technologist, U. S. Bureau of Mines

SOAPSTONE is sold chiefly in slab or massive form and in this discussion only slab or massive soapstone will be considered. Some soapstone is ground and sold for much the same purposes as low-grade, impure talc. The distinction between soapstone and talc should be noted. Talc is a definite mineral, whereas soapstone is a rock or an aggregate of minerals containing talc in greater or less quantity, together with chlorite, tremolite, pyroxene, quartz, calcite, dolomite, or other minerals. Its talc content is usually sufficiently high to give it a soapy "feel."

The domestic soapstone industry is peculiar in that there are only two or three producers, of which one is pre-eminent and accounts for nearly the total production. Moreover, the soapstone industry apparently has not been well developed in other countries, and little or no competition is experienced. The marketing of soapstone accordingly is not at present a complicated subject.

Soapstone is used primarily in the form of slabs, usually one to two inches thick, fabricated into laundry tubs, kitchen sinks, sinks, hoods, and table tops for laboratories; acid-resisting tanks, electrical switchboards, and for building material such as lavatory stalls, baseboards, shelving and stair treads. Its property of absorbing and retaining heat makes it of value for griddles, foot warmers and heating stones for fireless cookers. In the form of cores for electric heating elements in electric flatirons and similar appliances, the properties of electrical resistance and heat retention are utilized. In the form of brick, soapstone has been used to a limited extent as a refractory.

Most soapstone is cut and fabricated for the market by the producer at or near the quarry. Some soapstone is sold in the form of large rectangular blocks which may be sawn and fabricated nearer the centers of consumption, but most unfabricated material is marketed in large sawn slabs. These slabs are bought by companies that are making laundry tubs, sinks, and similar products, and occasionally by companies whose main business is the working of marble for structural purposes. "Raw material" marketing, however, is relatively infrequent and unimportant.

Soapstone products are sold all over the United States, and a small quantity is exported; but the consumption is largest east of the Mississippi, where the freight rate from the principal point of production in Virginia is not unduly high.

Virginia Principal Source of Soapstone

The chief marketing point is Schuyler, in Virginia, but small quantities have been shipped from Chester, Vermont; Arrington, in Virginia; Marriotsville, in Maryland, and from a few other localities. The Chester stone was fabricated largely at Boston; the Arrington stone locally, and the Marriotsville stone at Stamford, Conn.

The annual consumption of soapstone for the last ten years has varied from 12,330 short tons, valued at $501,059, in 1918, to 26,562 tons, valued at $628,077, in 1913. The average has been about 20,000 tons per year. There are no seasonal fluctuations in demand except in so far as building operations in the North and West are influenced by weather conditions.

No well-defined and generally accepted standards and specifications for soapstone have been evolved. Individual consumers have their own requirements—for example, dielectric strength tests for electrical switchboards—but there seem to be no definite standards. The principal requirement for slab soapstone is that it shall be sound and free from cracks, seams, and "shakes." Pyrite and magnetite are generally objectionable impurities, particularly when the stone is to be used for electric purposes, but for some uses they are not so regarded. For acid-proof tanks, the presence of calcite and dolomite is objectionable. Color ordinarily has no influence on price, except that for structural purposes iron oxide stains are undesirable. For refractories, fireless-cooker stones, griddles, and similar utensils, where the soapstone is subjected to heat, a stone high in talc and one which will not split and spall under heat is necessary. This last requirement is not always well met by some soapstone now marketed. It must be remembered, however, that deposits of soapstone of commercial size and of ideal character may not be available.

Shipments Are Usually by Carload Lots

Usually, the quantity of unfabricated soapstone handled in a single lot depends upon the capacity of a freight car, for carload shipments prevail. Small shapes and some fabricated soapstone articles are sometimes sold and shipped in small quantities.

No system of premiums and penalties prevails in the soapstone industry, and sampling by consumers is not practiced. As soapstone is not sold on the basis of analysis or physical tests, the consumer merely makes a visual examination, noting the quality, and the workmanship if it be fabricated.

The only requirements for transportation are that strong, well-designed crates be used, to protect the stone and prevent breakage in transit. Slab soapstone is always shipped on edge, as the liability of breakage is less than when placed flat on the bottom of the car. The only limit to the size of package is the size of the freight car. The minimum carload is usually 24,000 lb.; the maximum, the capacity of the car. No insurance is considered necessary.

The value of soapstone is variously computed by the square foot, cubic foot, ton, pound, or piece of finished product, depending upon the nature, shape, and size of the articles shipped. Thus, laundry tubes may be sold by the individual unit, block soapstone by the cubic foot or by the ton, and slab soapstone of a definite thickness by the square foot. The terms of payment vary, but follow those in common use in other indus-

*Published by permission of the Director, U. S. Bureau of Mines.

tries, namely, cash in thirty, sixty, or ninety days or deferred, secured payments.

There seem to be no special marketing problems which producers should know. However, possible new producers should consider the relatively small consumption, the efficiency with which soapstone is now being produced, the amount of capital required to equip an efficient plant, the freight rates to important markets, and the price at which competitive materials, for example slate, are sold in those markets. There are no trade groups or middlemen or combinations of producers which exercise any control over the market or marketing conditions or price.

The prices of soapstone products vary greatly, depending upon the amount of labor involved in manufacture. Thus, crude block soapstone brings the lowest price and fabricated articles or intricate shapes bring the highest prices. The present prices (April, 1922) vary from about $10 to $100 per ton. As the average soapstone runs from 11.2 to 11.5 cu.ft. per ton, the cubic-foot price varies from about $0.87 to $8.92 per cubic foot. These prices may be easily converted to prices per square foot for slab soapstone of varying thicknesses.

The marketing unit, as noted before, may be the square foot, cubic foot, pound, ton, or piece. In 1915 the U. S. Geological Survey reported that, when the average price for the year for all soapstone sold was $25.45, the value of crude, block soapstone was $2 or less per ton; when sawed into slabs the value was increased to more than $15 per ton; and when made into laundry tubs its average value reached approximately $30 per ton.

The average prices of all sawed and manufactured soapstone for recent years are shown in the following statistics from the U. S. Geological Survey:

AVERAGE PRICES OF SOAPSTONE
Per Short Ton

Year..	1912	1913	1914	1915	1916	1917	1918	1919	1920
Price..	$23.06	25.04	25.93	26.45	25.50	20.24	40.64	32.12	36.00

Imports have no influence on the domestic market, for soapstone in appreciable quantities has never been imported. Great Britain and some of the Scandinavian countries have produced a small quantity of soapstone, but it has never competed in our markets. This is probably due to the fact that the price compared to the weight is low, and transportation charges would be unduly high. It is reported that a large deposit of soapstone of excellent grade has recently been discovered in eastern Canada. The commercial exploitation of this deposit might have some effect on the domestic markets.

Telephone Takes Tenth of Country's Lead

The importance of lead in the maintenance of the telephone systems of the country is borne out by statistics just prepared by the Western Electric Co. At the company's plant near Chicago, which manufactures a good part of the communicating apparatus used throughout the country, there is consumed each year approximately one-tenth of the total amount of lead produced annually in the United States. In 1921, the factory purchased 53,111,000 lb. of the metal, which was used as a covering for 35,360,000 ft. of telephone cable—enough lead to fill 664 railroad cars of 80,000 lb. capacity each, and enough cable to reach from San Francisco to New York, with a piece left over long enough to reach from New York to London.

Texan Potash Interests Seek Relief from Foreign Monopoly

A group of ranch owners, business men, and oil companies in the potash region of Texas have petitioned Congress for legislation that will give the Texan potash industry relief from a foreign monopoly that they say threatens to prevent the development of the natural resources of Texas, which, when developed may furnish as abundant a supply of high-grade potash as the German and Alsatian mines and at a lower price to American consumers. Unless there is remedial action, the petition asserts, the United States will be left at the mercy of European operators so far as its potash supply is concerned, instead of being put in an independent position by developing its own supply of a mineral essential to crop raising, as well as in the manufacture of munitions.

The petition alleges that the German-French group has by co-ordination created "what in effect is a monopoly of the world's potash supply, based upon the limitation of natural resources and 'tying' contracts which evade the laws of the United States," and that "this monopoly, apparently manipulated by a German industrial group, has put out of operation American potash plants representing an investment of about $30,000,000, widely distributed throughout the United States."

"A new international problem faces Congress," say the petitioners. "Hitherto the national Government has not found it necessary to take action aimed at the regulation of international combinations in restraint of trade. Post-war conditions, however, are responsible for the organization of an international monopoly which Congress must cope with to protect the interests of the American people. Congress will have to face similar international combinations. We respectfully suggest that it might be well to develop a policy for dealing with them in a case in which the issues are so clearly drawn. The French government after the Armistice acquired the mines, and recently has been developing a plan for their control. What pressure the German interests brought to bear upon the French operators of the mines is apparent from subsequent developments by which American competition has been almost eliminated and the price of potash has been raised."

The petition then gives reasons for the belief in the probability of extensive development of the Texas potash fields. It calls attention to encouraging reports from the U. S. Geological Survey, although it indicates that the certainty of commercial deposits will not be revealed until more drillings have been made. These, it says, are now being put down.

Bain Analyzes Proposed Mine Law Revision

Complying with a request made by the Committee on Mines and Mining of the House of Representatives, H. Foster Bain, director of the U. S. Bureau of Mines, has analyzed the more important changes proposed in the revision of the mining laws prescribed in the bill now before the committee. The full text of Mr. Bain's statement, submitted to the committee since his departure for Alaska, may be obtained on application to the Bureau of Mines.

Ajo Enterprise of the New Cornelia Copper Co.—III

Electrolytic Precipitation Improved by Development of a Process for the Reduction of Ferric Sulphate by Sulphur Dioxide in Towers — Whole Leaching Plant Built With Exceptional Care—Operation Has Justified Innovations

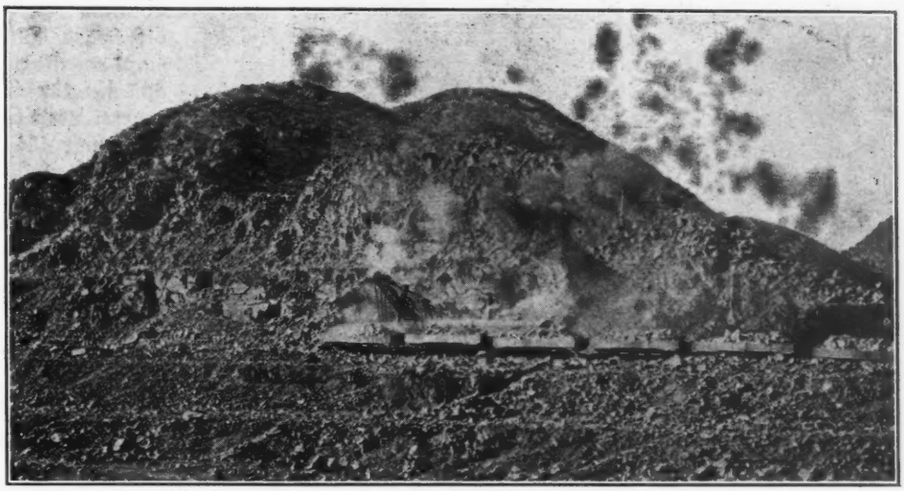
By A. W. Allen
Assistant Editor *Engineering and Mining Journal-Press*

THE SPECIAL FEATURES of the process adopted for the treatment of the oxidized ores at Ajo are summarized in U. S. Patent No. 1,224,458, which was issued to John C. Greenway and Harry W. Morse on May 1, 1917. The specifications discuss as a preliminary the difficulty experienced in the hydrometallurgy of copper ores containing iron, on account of the formation of ferric sulphate. This, as is well known, tends to dissolve the copper on the cathodes and to raise the potential difference necessary for electrolysis, thus causing a loss of electric energy. Iron in the ferrous form, however, is harmless; consequently, the general practice is to withdraw a certain proportion of the solution coming from the electrolytic plant and to subject it to reduction, then returning it to the main circuit. The electrolytic solution being acid, the efficiency of reduction is low; it amounts usually to about 20 per cent. The important feature of the Ajo process is that this proportion may be raised to about 80 per cent by using neutral instead of acid solution. Thus, it is possible to maintain a low content of ferric iron in the liquor going to the electrolytic cells. The application of the process is as follows, assuming the operation of the plant for a time sufficient to insure regular procedure: The solution is circulated through the ore, a proportion going forward and finally percolating through a fresh charge. Then, being almost neutral in reaction, it is passed through towers containing sulphur dioxide, by which nearly all the ferric iron is reduced to the ferrous state. One result of this reaction is the production of sulphuric acid, according to the following equation:

$$Fe_2(SO_4)_3 + SO_2 + 2H_2O = 2FeSO_4 + 2H_2SO_4$$

The amount produced, however, is generally insufficient for economical operation, so acid is usually added as required. To remove iron and base-metal compounds that accumulate, and to prevent fouling, a portion of the circulating solution is withdrawn and treated with metallic iron, the cement copper formed being afterward dissolved in a solution coming from the electrolytic cells, so that any resultant ferric sulphate is reduced to the ferrous state. The solution then goes to the electrolytic department, where copper is precipitated.

A part of the acid solution from the cells goes to the leaching vats. The object of the procedure adopted is not to remove all the ferric iron from the solution at any stage of operations, but to reduce the amount previous to passage through the electrolytic cells. The presence of a certain amount of ferric iron in the solution is beneficial, for it acts as a solvent of the copper in the ore. The claims sustained show that the patent covers the use of a solution of sulphuric acid to extract the copper, such solution being maintained in contact until almost neutral; a part of the effluent is then subjected to reduction in towers through which sulphur dioxide is passed, after which the copper is recovered by electrolytic precipitation, with or without previous acidification of the solution with sulphuric acid; or a part of the recent leach solution is treated with metallic iron, another part by sulphur dioxide, the metallic copper produced during the former reaction reducing a further amount of the ferric iron in the solution, the liquor being subjected ultimately to electrolytic precipitation of a proportion of the contained copper.



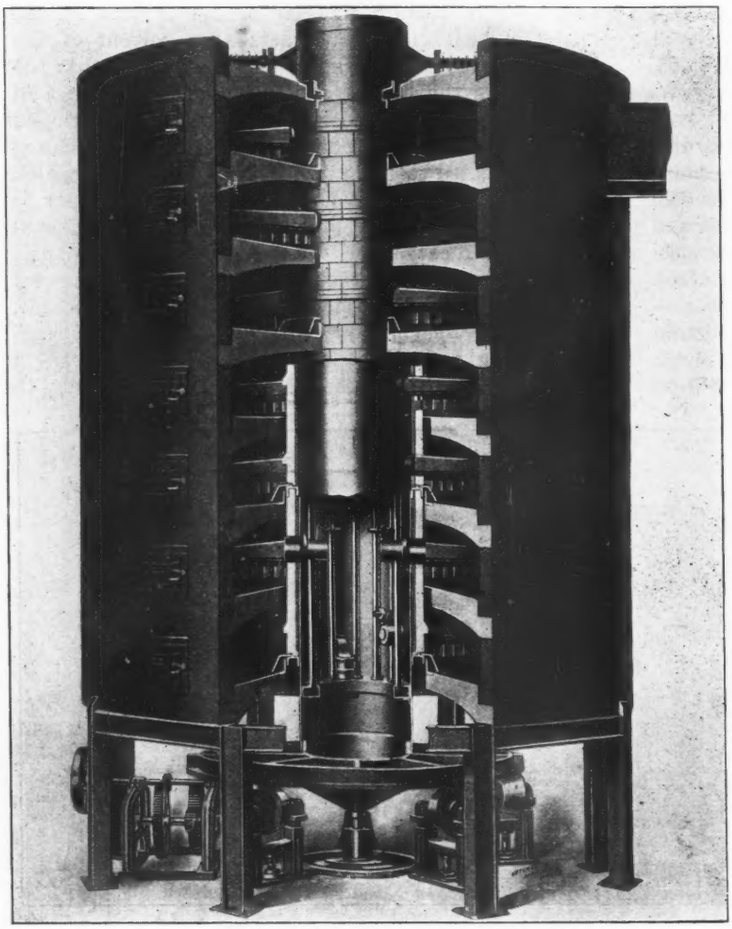
Mining the third and last hill, December, 1921

Mention has been made in previous articles of the weight of expert opinion and experience that supported the metallurgic decisions made in reference to the proposed treatment of Ajo ores. In the mining department, also, no experiments were made in the selection of the men to take charge of the work. Michael Curley was appointed general superintendent, and Frederic Ekman, mine superintendent, both of whom were thoroughly conversant with a system of mining that has since proved capable of successful adaptation at Ajo, for both had learned what there was to know on the subject in the iron mines of the Lake Superior region.

Co-operation between the mining and metallurgical departments showed that the ore should be delivered at a point where sufficient fall by gravity would be available for primary as well as for secondary crushing in gyratory breakers. A cut was made through a hill overlooking the town site and close to the present coarse-crushing plant. A standard-gage single track was laid from there to the mine—a distance of about 4,000 ft. A trestle approach to the coarse-crushing

plant was designed in accordance with the weight and type of locomotive and cars chosen as most suitable. There is a difference in elevation, between the approach to the pit and the trestle, of 14 ft.; this gives a maximum adverse grade, when hauling ore, of about 1.8 per cent.

A certain proportion of the oxidized ore available was contained in three hills, two of which have already been mined and milled. The third is now as shown in the halftone. The sides of the hills were steep. Mining by means of intermediate benches was considered impracticable. It was decided to break the ore in such a way that the removal of all of it would be possible from the base, where the railroad track would be laid. Steam shovels with dippers of 4-cu.yd. capacity were chosen as being adequate in size to take the rock without excessive expense for reduction of large pieces by block-holing. The Osgood company's machines were favored, a choice that has not been regretted. Air-dump cars holding about forty tons were considered preferable, the Kilbourne-Jacobs type being adopted. The scheme of mining involved combination blasting by means of explosives placed in drill holes and also in adits and crosscuts, the latter procedure being used in high banks.



Wedge furnace used at Ajo

Design of the Treatment Plant

A milling capacity of 5,000 tons per day having been decided upon, the design of the plant, under the supervision of Mr. Greenway and Dr. Ricketts, was placed in the hands of A. G. McGregor. David Cole was also consulted, and, later, designed an experimental flotation plant. It was realized that first cost and future operating cost should be the main considerations in the selection of equipment, and Mr. McGregor considered that there was less chance for a serious mistake in selection than there was in the grouping and the arranging of the various units. It is important in such work that the characteristics of the equipment adopted be understood fully; also, that it be installed so that conditions of operation will be as nearly ideal as possible. A number of feasible plans are usually given consideration before final decision is made; any one of these can be adopted with assurance of ultimate success, provided the work is carried out with proper skill and attention to detail.

The plant at Ajo gives the impression of unusual permanence. This is partly owing to neatness of design and to the use of concrete and iron throughout. The approximate weight of steel used in the principal structures, supplied by the Kansas City Structural Steel Co., is of interest, for in the aggregate it amounted to no less than 2,500 tons. The power-plant building required 500 tons; the electrolytic-cell house, 400 tons; the storage bins and the sulphur dioxide buildings, about 200 tons apiece; the trestle approach, 215 tons; the central structure between the leaching vats, 160 tons; the coarse-crushing plant building, 280 tons; and the fine-crushing plant building, 115 tons. Gyratory breakers were chosen for primary and secondary crushing. Belt conveyors were selected throughout for the conveyance and elevation of the crushed ore, except in the fine-crushing department, where belt-and-bucket elevators raise the discharge from the penultimate crushers into the chutes leading into the final crushers. A 10,000-ton steel bin provides storage for the ore after it has been crushed in the gyratories and is then in a condition to be handled by belt conveyors and feeders. This permits elasticity of operation and control in the coarse-crushing plant. So far no method has been devised which will prevent delay due to lack of storage facilities in the coarse-crushing section. It would be uneconomical to adopt a primary crusher of such a size or to duplicate the unit so that the rock could be reduced as fast as it could be delivered by a train of ore cars. At Ajo the cars are dumped one at a time into the hopper of the large gyratory crusher, the locomotive remaining attached meanwhile; but it is obvious that the locomotive and attendants are delayed for considerable periods, waiting for the hopper to empty. This appears to be one of the disadvantages of air-dump cars, which require connection to auxiliary apparatus in the locomotive so that they can be tipped. Alternative practice is indicated by the method adopted elsewhere—at Chuquicamata and at the Arthur mill of the Utah Copper Co., for instance—where no gravity fall into the primary crushers is available, where there is no approach trestle of appreciable height, and where, in consequence, large ore cars can be used. At Chuquicamata the train of cars is left on the track leading to the unloader, the brake on one car at a time being released so that it can run by gravity into the receiver of a Wellman-Seaver-Morgan electric hoist-unloader, by which it is lifted and dumped

onto the grizzly that leads to the primary crushers. At the Arthur mine in Utah[1] the same type of hoist-unloader is in use, but each car is pushed up an 11 per cent incline for a short distance into the dumping cradle of the unloader by a diminutive locomotive "mule," which is controlled by the operator in charge of the car-dumping mechanism. In both plants the cars serve as efficient storage bins for the unbroken rock, permitting an even delivery of material into the crusher without involving waste of time, labor, or power.

Development of the Disk Crusher

Although various and sundry types of crushers have been used to prepare ore for leaching treatment, it is obvious that, where no classification and separate treatment of slime is feasible, the product must contain a minimum of exceedingly fine sand and slime. In copper ores this is largely because of the coarse character of the charge; increased crushing, to within certain limits, would permit the inclusion of a greater amount of fine material, because less movement of slime would result.

In the earlier work at Douglas some negative results were obtained because of the character of the mass leached, not because of the nominal size to which it had been crushed. Horizontal as well as vertical disk crushers were used in the experimental plant at Ajo. A 48-in. horizontal type of machine reduced the ore from 4 to 1½ in. It was then passed to a vertical disk crusher, or fine reduction machine of the same size as the other but in which the disks were horizontal.

No screening was practiced. Sundry minor structural weaknesses were noticed in the apparatus, which at the time had just passed the experimental stage; the principle of operation, however, was so attractive that further improvement in design was thought to be justified.

Early in January, 1915, David Cole, who was consulted concerning the fine-crushing plant at Ajo, felt that the good work done in the experimental plant could be duplicated on a large scale, and that the disk crusher could be modified in design so that a satisfactory leaching product could be obtained at a reasonable cost and without the necessity for the excessive "repairs" that had been found necessary in plants using the Symons machine. Chalmers & Williams, the manufacturers of the new crusher, were willing; and Mr. Cole was given authority to re-design the apparatus. Details of the development of the machine now in use, as well as of later models, will be described by Mr. Cole in a separate article.

Lead was chosen as the most suitable material for the piping to convey acid solution, for the lining of the leaching vats, and for the construction of anodes. The small amount of trouble experienced from corrosion since the plant has been in operation is evidence of the care taken in preliminary investigation in this direction, although the results are contrary to much experience elsewhere. The only minor alteration made was to protect with wood the lead that was exposed, on the sides of the leaching vats, to the abrasive action of the sand in the solution that short-circuited in consequence of the high rate of percolation. A bottom support of perforated wood was adopted. Two types of acid-pump were chosen, because no one factory could deliver all the equipment required in the limited time available. These were supplied by the Worthington Pump & Machinery Co. and by the Chemical Valve & Pump Co., of New Jersey.

Sulphur was used in the experimental test to produce the sulphur dioxide needed for the reduction of ferrous iron, but much trouble was experienced. The process involved the use of a comparatively rich sulphur-dioxide gas. The problem was to determine the cheapest method of production. The matter was finally submitted to the Wedge Mechanical Furnace Co., the idea being to use sulphide ores from Bisbee. A. G. McGregor and H. A. Tobelmann, as representatives of the New Cornelia company, visited various plants in the Eastern states where Wedge furnaces were in operation and producing a gas used in sulphite-pulp digesters. In that industry it is desirable to secure as rich a gas as possible, containing a negligible quantity of sulphur trioxide or free oxygen. The furnace in use in the sulphite-pulp mills, roasting a pyrite with a sulphur content of about 42 per cent, can produce a gas that averages 13.8 per cent of sulphur dioxide. After this investigation and after a consideration of comparative costs, it was decided to use Wedge furnaces of the sulphite-pulp type at Ajo.

The objection to the use of pyrite as a source of sulphur in the sulphite-pulp industry arose because uncalcined particles of ore were carried by the gas into the pulp. It was planned at Ajo that the gas from the roasters would pass through a short balloon flue to a Cottrell electrical precipitator, for the removal of the dust. This apparatus was found unnecessary and was later discarded. Disadvantages in connection with the use of pyrite as a source of sulphur dioxide were more than counterbalanced at Ajo by the fact that the parent company, the Calumet & Arizona, controlled large deposits of sulphide ore at Bisbee, which must be roasted before treatment in the smelter at Douglas. It was therefore planned to send sufficient of the ore from Bisbee to Douglas via Ajo, where it would be deprived of its sulphur. This is a striking example of the benefits of co-operation in industry, by which two processes that individually might be considered as prohibitively costly can be operated on a co-operative basis at reasonable expense.

To be concluded

[1] *Min. & Sci. Press*, April 5, 1919.

Tests of Mine-Locomotive Storage Batteries

The Bureau of Mines has undertaken to establish a list of permissible storage-battery locomotives for use in gaseous mines, and has issued Schedule 15, "Procedure for Establishing a List of Permissible Storage-Battery Locomotives for Use in Gaseous Mines." Up to the present time, two approvals have been issued under this schedule and considerable testing work has been done on four other applications which have been made for approval.

Prior to the publication of Schedule 15, the Bureau conducted field and laboratory investigations to determine the hazard from batteries used in mine locomotives. These investigations indicated that the safety of the locomotive would depend largely on proper care of the battery; also on the use of a battery as mechanically rugged as possible. For this reason the Bureau staff considered it advisable to subject the batteries to a jarring or bumping test to prove their adequacy as regards mechanical endurance and ruggedness. These tests on the batteries of the locomotives are described in Serial No. 2,358, *Reports of Investigations.*

Geological Experts—What the Judge Thinks

By Doska W. E. Monical

IN MINING LITIGATION, do two sets of witnesses, placed on opposing sides, bring about the desired results? Is the present legal procedure efficient? Some writers assert that because the testimony of one witness so often counterbalances that of another, the whole system, like competition in armaments, is futile. Is this true, or is the net result of the opposing arguments the shaking down of the geologic facts?

One indication of the effectiveness of expert testimony is the reaction of the presiding judge toward it. To get a concrete measure in this direction, I have reviewed the decisions in all the important *reported* mining cases of the last forty years, with some attention to those of preceding years. Following is a detailed list of the cases, with excerpts from the judge's opinion wherever he has made any laudatory or disparaging remarks regarding expert witnesses. Where no excerpt is made, the judge has delivered no opinion relative to the testimony. These excerpts are proffered for their intrinsic interest and without comment.

In 1880, in the case of Overman Silver Mining Co. v. Philip Corcoran *et al*, Judge Hawley, delivering the opinion, said:

"Every lawyer at all familiar with the trial of mining cases where the question of existence, or non-existence, of a lode or vein is raised, understands the difficulty that is often, we might say always, encountered in the attempt to ascertain the facts. Practical miners, experts, and men of science are often examined as witnesses, and they frequently differ as much in their statement of facts as in their conclusions of judgment."

In 1882, in the case of James Harrington *et al* v. Robert C. Chambers *et al*, the judge made no remarks regarding expert testimony.

In 1886, in the case of Hyman v. Wheeler and others, Judge Hallett, charging the jury, said:

"The number of witnesses called by the parties was governed by rule of court, so that one could have no advantage over the other in that respect; and the witnesses are arrayed in point of numbers on party lines, half on one side and half on the other, so as to produce an embarrassing conflict of testimony. Such conflict is not an unusual feature of testimony in a mining suit. It has become so common and general that many thoughtful men entertain doubts as to the value and efficiency of trial by jury in such cases. If a given number of witnesses of fair character and intelligence can be produced at the will of the parties for or against any proposition that may arise in a mining controversy, without reference to the truth of the matter, of course the result of such an investigation cannot be very satisfactory."

In 1890, in the case of Cheesman *et al* v. Hart *et al*, Judge Philips, delivering opinion of the court, said:

"My observation at this trial satisfies me that an important mining litigation is a model training school for expert testimony; and if there ever is a case where the judge himself, like the witnesses in this case, should have the largest latitude of taking part in the discussion, it should be accorded in such cases, at least so far as it 'is profitable for doctrine, for reproof, for correction.'"

In 1893, in the case of Doe v. Waterloo Mining Co., the judge made no remarks regarding expert testimony.

In 1889, in the case of Cheesman *et al* v. Shreeve *et al*, Judge Philips, charging the jury, said:

"Some of the witnesses, unquestionably, have not told the truth; and it is for you to conclude who they are, and whom you will believe. Judging from this trial, there must be something in the altitude of that mountain, or the depths of its mines, wonderfully prolific of falsifiers and orators. From the men of science, versed in geology, mineralogy, and mining engineering, to the most unlettered miner who dwells in the bowels of the mountain, many of them seem to be orators; and, immediately after taking the witness stand, they would be found on the platform, on the same plane as the judge, making a speech to the jury, with all the warmth, energy, and zeal of hired advocates. Some of them were simply partisans, and seemed to have forgotten the office which the law and the obligation of their oath imposed upon them, to speak to the truth of their knowledge, and to tell nothing but the truth. Such exhibitions are to be deplored. They tend to break down the popular respect for the solemnity, dignity, and justice of judicial trials; and, where they obtain, trials are likely to become a mockery, and justice a failure. It will be found, however, gentlemen, in this case, as in the vast majority of trials, that the prominent, controlling facts in the great mass of testimony lie within a small compass."

In 1889, in the case of Butte & Boston Mining Co. v. Société Anonyme des Mines de Lexington, Judge Hunt said:

"The evidence was conflicting, many experts for plaintiff claiming that the apex of the vein from which the ores were extracted was in plaintiff's ground, and that it was wholly disconnected with any vein in defendant's ground, while an equal number of expert witnesses called by the defendant testified that, in their opinion, the apex of the vein was in the defendant's ground."

In 1899, in the case of Golden Reward Mining Co. v. Buxton Mining Co., Judge Thayer, delivering opinion of the court, said:

"The witness from whom this evidence was elicited was certainly competent, by reason of his training and experience, to form an opinion on the subject to which the inquiries were addressed which would be more reliable than an opinion formed by a person who lacked in special knowledge, training, and experience."

In 1900, in the case of Argonaut Mining Co. v. Kennedy Mining & Milling Co., the judge made no remarks regarding expert testimony.

In 1905, in the case of Wall *et al* v. United States Mining Co., District Judge Marshall said:

"I am aware that some experts color their opinions to suit their interests, too readily assuming that they are justified in advancing specious arguments to support their employer's side of the case; but it has not been my experience that they deliberately misstate facts, as distinguished from opinions, with greater frequency than other witnesses."

In 1912, in the case of Collins v. Barley *et al*, Judge Tully Scott, delivering opinion of the court, said:

"We can find no case wherein such a wild guess has been accepted as proof. In fact, the most that can be said in favor of such a conclusion is that it is the opinion of an engineer. But in view of the many worked and ore-bearing veins in the same locality, on the same mountain, with similar dip and strike, this opinion can be regarded as but little, if anything, beyond a guess, and mining engineers cannot be said to be infallible as guessers."

In 1915, in the case of Stewart Mining Co. v. Ontario Mining Co., Judge McKenna said:

"The court observed that the decisive assignment of error was lodged against the finding that the vein had not its apex in the Senator Stewart Fraction claim, and, after referring to the testimony of witnesses as to the inclination and apparent strike of the vein at certain points, said: 'But, taken as a whole, the evidence supports the findings, and the controversy arising on this appeal becomes a question as to the correct interpretation and application of the rule of law that should apply to the facts of the case.'"

In 1916, in the case of Jim Butler, Tonopah Mining Co. v. West End Consolidated Mining Co., Judge Averill made no remarks regarding expert testimony.

In 1916, in the case of Butte & Superior v. Clark-Montana Realty Co., Judge Bourquin said:

"The testimony is of five experts for each party, all men of eminence in geology, or mining engineering, or both. For plaintiffs are Greene of Butte, Irving of Yale, Mead of New York, Searls of Nevada, and Winchell of Minneapolis. For defendant are Finch of Denver, Emmons of Minnesota, Salisbury of Chicago, and Burch and Urley of California. There is some conflict of facts and more of argument, opinions, and conclusions. Most of it can be imputed to the complex geological and other problems, conditions underground, difficulties of observation, and honest differences of interpretation by reasonable and learned men. But in instances partisanship apparently impaired judgment. As a whole, however, the testimony inspires confidence and deserves careful consideration. . . .

"The court finds that the northerly wall of the Rainbow apex crosses the common side line 190 ft. from the southwest corner of the Blackrock, and that the southerly wall so crosses 301 ft. from said corner. For plaintiff the testimony is that the latter crossing is 'about' 308—rather the extreme and indefinite limit of the mineralization which accompanies the vein—to 314 ft.; for defendant, 'about' 300 to 301 ft. All agree there is no defined wall—that it is indefinite and leaves much to judgment. Considering the evidence in light of inspection and that the burden of proof is upon plaintiff, it is believed that the concession of defendant is more nearly right and as favorable to plaintiff as the facts warrant. The exposure is in a surface trench, and it is difficult to distinguish vein matter in place from mere seepage effect in adjacent country, whether of vein solutions or surface waters, and perhaps mushrooming beyond the limits of the vein proper below. A shaft might have contributed to accuracy. Finch testified that within the limits of the 300 ft. he included 15 ft. to the extreme limit of rock alteration, with a few little seams in it 'to be consistent with the interpretation of a vein at other points.' This is admirable frankness, but imports that at vital points and to indefinite extent he characterized that as vein which in his judgment is not vein, to serve his client and avoid haphazard of comparison. The difficulty is that, when an expert shades his testimony upon the principle *do ut des*, partisanship is likely, if not certain, to favor his client, and the court cannot determine to what extent, inevitably detracting from the weight of his opinion."

In 1917, in the case of Geddes *et al* v. Anaconda Copper Mining Co., Judge Ross made no remarks regarding expert testimony.

In 1917, in the case of Bourne v. Federal Mining & Smelting Co., Judge Dietrich said:

"Upon the whole, the relation of the witnesses to the parties was such that presumptively it may be said that the witnesses for the defendant were more interested in the result than those of the plaintiff; but in consideration of the nature of the issue and the absence of any evidence of a disposition on the part of the witnesess upon either side to be unfair, I am not inclined to attach great importance to this feature of the case. No question is made of the honesty or integrity or general character of any of the witnesses. They do not differ widely concerning the evidentiary facts, and it is not strange that they should take different views of the significance of these facts and the scientific conclusions to be drawn therefrom."

In 1918, in the case of Original Sixteen to One Mine, Inc., v. Twenty-one Mining Co., Judge Rudkin said:

"The experts on each side consisted of geologists, mining engineers, and practical mining men. It is almost needless to say that the opinions of these experts were positive and unequivocal in favor of the party who called them, and little would be accomplished by adding one or more additional experts to the long list already on the record."

In 1920, in the case of Star Mining Co. v. Federal Mining & Smelting Co., Judge Ross said:

"Sufficient reference has already been made to the inconsistent testimony and opinions of the distinguished geologists of the respective parties, the nature of which confirms us in the opinion that in the consideration and decision of such cases it is safer, and consequently more satisfactory, to rely upon the testimony of expert mining engineers who are familiar with the mineral formations and deposits of the particular district and upon the actual work and observations of experienced mining superintendents who have active charge of the work in such mines."

Healthful Mine Conditions Demand Intelligent Operation of Wet Drills*

Notwithstanding all the effort made to introduce wet drills to prevent dustiness of air of metal-mine working places, there has during the last few years arisen in Australia and South Africa an impression that wet drills, including the Leyner type, actually cause undue quantities of finely divided ore and rock to rise into the air, these fine particles being chiefly attached to particles of fog or spray escaping from holes using water drills. This is said to have created consternation in the ranks of the mine operators who have complied with drastic wet drilling regulations and purchased and operated various types of wet drills.

In view of this situation and the fact that wet stopers are being rapidly introduced with considerable success in many of the metal mines of the United States, D. Harrington, who has for the last five years been engaged largely in studying the dust problem in the metal mines of the West for the U. S. Bureau of Mines, has compiled the dust sampling of air of drilling places in 214 workings in thirteen mines at time of drilling, using various types of wet and dry drills with upper, inclined, horizontal, and some down holes. The result of these tabulations indicates that irrespective of the conditions in South Africa and Australia, the use of wet drills in the United States results in a decided decrease of dustiness of the surrounding air as compared with dry drilling, whether the holes are upper, or inclined, or horizontal, and practically irrespective of the types of drill used. Nevertheless, there are some dangers from dust in air surrounding wet drilling operations unless certain precautions are taken.

The dust studies to date in metal mines of the United States by the U. S. Bureau of Mines indicate definitely that wet drills as used in drilling of all classes of holes aid decidedly in reducing dustiness of air in drilling places. However, it has been found that wet drills, whether of the Leyner type or stopers, if not operating satisfactorily or if out of repair, may throw into the air of working places a mist or fog, laden with minute mineral particles, which when breathed has the same effect as dry dust and is fully as dangerous. In addition to danger when wet drills are not efficiently used, if water or compressed air and water forced through the drill is under excessive pressure, say over 100 lb. per square inch, there may be danger of escape of mist or fog laden with mineral particles; hence these pressures should be held below 100 lb. per square inch, which, in general, is the practice in the United States.

Wet drills must be kept in repair and must be operated with intelligence. As far as proved by the sampling of the Bureau of Mines, the wet drills, even when at their worst, still give conditions much more healthful than do dry drills.

*Abstract of a paper, "Drilling and Dustiness of Metal-Mine Air," by D. Harrington, *Reports of Investigations*, U. S. Bureau of Mines. Serial No. 2339.

USEFUL OPERATING IDEAS

Seneca's Novel Man Cage

Built on Ferris Wheel Principle for Use in Compound Shaft—Other Notes—Shaft Spillage Eliminated

BY HENRY M. PAYNE

THE Seneca shaft of the Seneca Copper Corporation, Calumet, Mich., has two compartments, with a ladderway in the center. The first 1,320 ft. is vertical. The shaft then passes through an arc of 610 ft. on a 600-ft. radius and into a slope at 32 deg. for 770 ft. further. The curved part is provided with twenty 4-ft. sheaves in each compartment.

In order to handle both ore and men in such a hoistway and keep the skips at all times vertical, a specially designed skip has been devised by W. J. Uren, superintendent at the Seneca. This skip, which dumps like a Kimberley, has proved markedly satisfactory and successful.

The man skip is not unlike a single cage of a Ferris wheel, suspended on trunnions between two vertical steel beams. The top is rounded to avoid hitting the roof, on the curved part of the shaft, and the entire cage is covered with heavy wire net. To reduce oscillation when in motion, and owing to change of direction, the pantograph side bars are attached to oil cylinders, which act in the same manner as shock absorbers on an automobile, and adjusted to any given load and speed. As a result, the cage passes through shaft, curve, and incline as steadily and as normally vertical as though continuously in a straight shaft.

Automatic gates are in operation at the ore chutes, so that instead of the estimated 8 per cent spillage usually occurring, there is none. It is Mr. Uren's theory that the discharge of the chute should be in exact conformity to the angle of the shaft above. The measuring box requires sizing of the rock, which at no time should exceed one-third of the internal diameter of the chute. Under these conditions a seven-ton skip is loaded without spillage in five seconds.

The drifts are 8 x 12 ft. in dimension, with a 24-in. gage track. Six-ton cars on two four-wheel trucks are used for tramming, the body being 16 ft. long and 4 ft. 4 in. wide, with drop doors. The axles of the trucks are 30 in. wide center to center.

The Gratiot shaft, which was recently taken over by the Seneca company, extends for thirteen levels at an angle of 34 deg. and will, when deepened, intersect the Seneca workings at a distance of 3,200 ft. The upper 100 ft. of the shaft is being lined with concrete, forming three compartments, the manway being fitted with a concrete stairway. The hoistways are being laid with 60-lb. rails bolted to 6 x 10-in. stringers laid in concrete sockets. The manway stairs are faced with creosoted planks, bolted down.

A new power house is being built at the Gratiot, on posts to facilitate construction. The building foundations, around the engines, will be laid during the summer.

Supplies Required in Mine Track Work

BY GEORGE J. YOUNG

In the construction of mine tracks considerable variation is encountered in the track gage, size of tie, spacing of ties, and in the weight of rails used. The minimum gage is 18 in., and for ordinary hand-tramming a 16-lb. rail is used. For light motors 25 to 30-lb. rails and for heavy motors 35 to 50-lb. rails are used. Ties in most cases are used transverse to the track length, but in a few instances two longitudinal stringers are used to support the tracks.

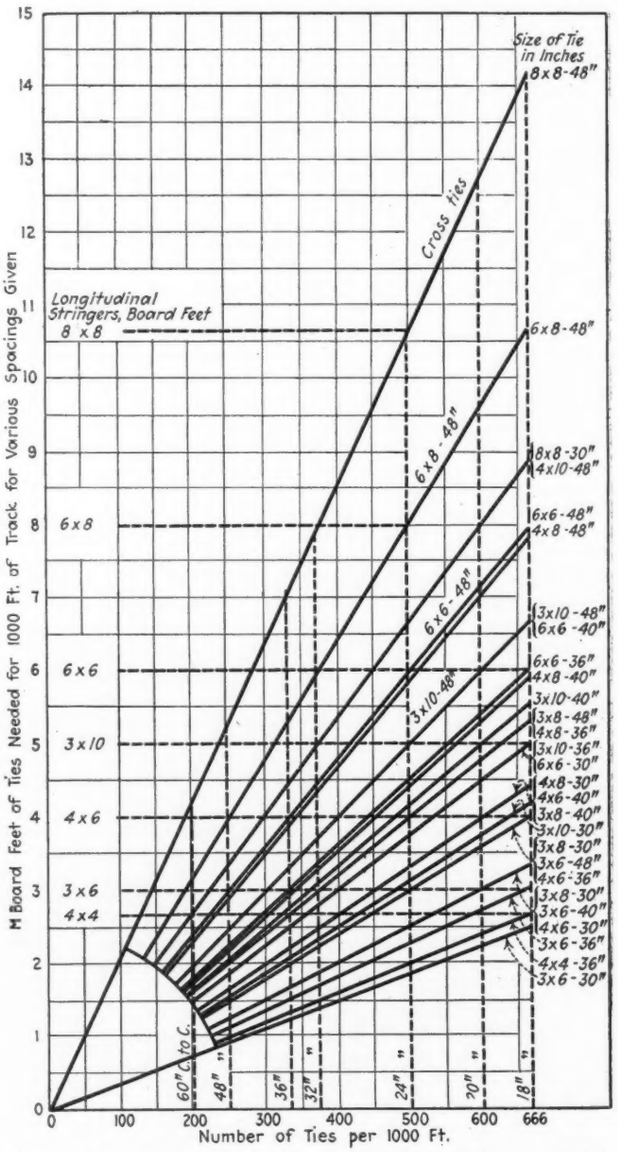


Chart showing board feet and number of ties needed in mine track work

Where a solid rock bottom free from ground move-

ment characterizes the drift or adit, the longitudinal stringer support for the track is worth consideration. The smallest tie used is 3 x 6 x 30 in. in length. Smaller ties are used, but only for unusually light work.

Tie spacing ranges from 18 to 60 in., center to center. The accompanying diagram enables the total number of board feet required for 1,000 ft. of track for the sizes of ties specified to be readily determined. The diagonal lines give the board feet for cross ties, with various spacings, and the horizontal heavy lines the board feet required for two longitudinal stringers for the 1,000 ft. lengths of track. In addition, rail weights, track spike and bolt sizes are given.

TRACK SPIKES FOR 1,000 FT. OF TRACK

	Inches Center to Center						
Spacing of ties	18	20	24	32	36	48	60
No. of spikes	2,664	2,400	2,000	1,500	1,332	1,000	800

BOLTS FOR 1,000 FT. OF TRACK

Two hundred and sixty-four bolts are needed per 1,000 ft. of track, using 30-ft. rail lengths, 66 joints. Double the number of bolts needed for 15-ft. rail lengths.

WEIGHT OF RAILS FOR 1,000 FT. OF TRACK

Wt. of Rail Lb. per Yd.	Wt., Lb.	Size Spike, In.	No. Per Lb.	Size Bolt, In.	No. Per Lb.	Wt. of Fish Plates Per Pr,, Lb.
12	8,000	3 x⅜	7	½x2	2.62	3.44
16	10,656	3 x½	7	½x2	2.62	4.36
25	16,650	3½x½	3.35	½x2½	2.45	5.70
30	19,980	3½x½	3.35	½x2½	2.45	10.45
35	23,310	5 x½	2.5	½x3	1.33	12.10
40	26,640	5 x½	2.5	½x3	1.33	16.10
45	29,970	5 x⅝	2	½x3	1.33	18.75
50	33,300	5 x⅝	2	½x3	1.33	25.05

Non-cupellation Method of Gold-Bullion Assay

BY A. W. ALLEN

The customary procedure adopted in assaying bullion for gold has persisted for so long without appreciable modification that the question of an alternative method has been considered by few. This is due largely to the fact that current practice permits an estimation of both gold and silver in the bullion. Recently, however, Arthur Westwood aroused interest at a meeting of the Institute of Metals by describing the following novel procedure, which has given satisfactory results. In this the cupellation phase is omitted, and copper is used in place of silver as the inquarting element.

The amount of bullion taken for assay, according to the originator of the method, is five grains—a fact that draws attention to the system of weights and measures still in vogue in England, even in precision work such as assaying. To this is added copper in amount so that the total weight will be from two to two and one-fourth times the amount of gold present. A gas muffle-furnace is used, the muffle being replaced by five or six silica tubes, 1⅛ in. internal diameter and 3 ft. long; these project from the front of the furnace for half their lengths. The copper-bullion tests are melted, each in a clay cup of a shape to fit the tube, and each tube taking ten cups. The tubes are connected at the back of the furnace with a small boiler; the front ends of the tubes are open to the atmosphere. A steady flow of steam is maintained during the melting and cooling of the tests.

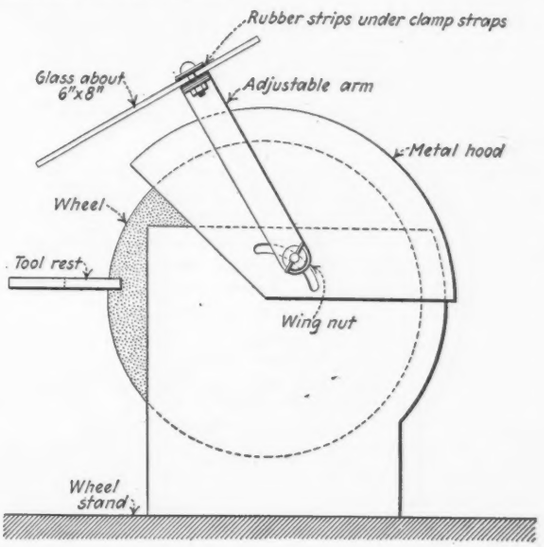
Melting, provided a temperature slightly above the melting point of copper is maintained, is done in five minutes. The tests are then withdrawn toward the open ends of the tubes to cool. On removal, the beads are hammered and rolled in the usual manner. Annealing is unnecessary. The fillets are then folded, and parted with acid.

The new method has the merit of extreme simplicity. Its adoption should result in an appreciable economy of time and labor in those operations where an estimate of silver content is not required. Mr. Westwood has published sundry data in support of its accuracy; but the scope and application of a non-cupellation method in general metallurgical work remains to be estimated. The fundamental idea is attractive and will doubtless appeal to many assayers.

Glass Shield for Emery Wheel

BY W. J. TAIT

The glass shield shown in the in the accompanying illustration has been found of considerable value in protecting operators of emery wheels. It obviates the use of goggles, with all their attendant troubles, such as broken parts, dirty lenses, and the general dislike manifested toward them.



Glass shield to protect operator of emery wheel

In addition, the operator cannot inhale the particles thrown up by the wheel. This is a greater menace than is ordinarily supposed, as large numbers of these particles are not visible but show their presence by pitting the shield.

The glass used is a piece of plate from a broken windshield, and all the material is usually available in the ordinary shop. By mounting the glass in a hinged holder, it can easily be pushed out of the way when desired.

Various adaptations can be made so that the shield will work without interfering with the usual operations in a shop.

Pouring Copper for Wire Bars

Side-dump ladles have been installed at the Quincy smelter, in northern Michigan. These pour tangentially, thus enabling continuous pouring for wire bar, it having been found that intermittent pouring causes a jolt in the unset metal at the moment of solidification, which affects the quality of fiber in the finished product.

THE PETROLEUM INDUSTRY

Naval Oil-Reserve Leases Explained By Secretary Fall

DECLARING that he was defending neither specific acts nor general policies regarding the leasing of Naval Oil Reserves, but that he was merely offering a frank and full explanation of the reasons and motives of himself and the Secretary of the Navy in the performance of such actions and the establishment of such policies, Secretary Fall of the Interior Department has made a long report to the President. It says in part:

"The naval petroleum reserves were created by order of the President, and out of the lands theretofore withdrawn as general petroleum withdrawals and are as follows:

"No. 1, Sept. 2, 1912, 38,969 acres, in Elk Hills, Cal.

"No. 2, Dec. 13, 1912, 29,341 acres, in Buena Vista Hills, Cal.

"No. 3, April 30, 1915, 9,481 acres, Teapot Dome, Salt Creek, Wyo.

"The geographical situation of Naval Reserves Nos. 1 and 2 has been hereinbefore casually referred to. With reference to the oil development, it may be stated that there exists competition in these fields between some of the large companies of the United States, among others the Standard Oil, the General Petroleum, the Associated Oil, the Pacific Oil, the Union Oil, the Pan American, and others. There are four pipe lines upon Naval Reserve No. 2, with one pipe line owned by the Standard Oil upon Naval Reserve No. 1, other pipe lines adjacent to such reserve, and still another large pipe line building into Naval Reserve No. 1, with the prospects of still a third line entering such reserve.

"These respective pipe lines lead to refineries upon the Pacific Coast and thus afford an opportunity for the Navy to dispose of its oil, at competitive bids, upon each of said reserves, to exchange crude oil at the well for fuel-oil certificates calling for delivery at the Western seaports; or, if it so desires, to have its oil conducted as it comes from the well through such pipe lines, directly to the coast, at such points as may be reached, particularly Los Angeles and San Francisco.

"With reference to petroleum reserve No. 3, in Wyoming, of course, it is well understood that the geographical situation is entirely different. In an air line from the Salt Creek field, in Wyoming, to Los Angeles it is approximately 1,000 miles. By air line from said Salt Creek field to Norfolk, Va., and points north it is approximately 1,700 miles. No pipe lines connecting this field with either coast have ever been constructed. The only pipe lines in the vicinity of naval petroleum reseve No. 3, or in the Salt Creek field, is the one pipe line of the Midwest Refining Co., with a total length of approximately fifty miles, extending through the field and to the refineries of the same company at the city of Casper. To transport the oils from the Salt Creek field, which is now producing, and from that portion of the same known as petroleum reserve No. 3, it would be necessary either to use tanks mounted upon vehicles, which, of course, would be nonsensical, or to extend the present Midwest line a short distance and use it for transporting oils to Casper, from which point, however, the crude oil, or any products thereof, would necessarily be transported then upon tank cars of the railroads touching that place. The facts, however, are that the present capacity of this pipe line is not sufficient to take the present production of the Salt Creek field.

"It is of peculiar interest to note that from the experience of others engaged in the production of oil, and through the research and experiments and experience of the Bureau of Mines experts through actual tests in the field and checking tests in the laboratory, it has been stated, and is generally conceded as an established fact, that through no present known process of pumping, or through the natural flow of an oil well can more than 20 per cent of the oil contents of an oil sand be extracted. These facts have been pointed out in Bulletin No. 148 of the Bureau of Mines, issued in 1917, which bulletin, unfortunately, has proven of interest only to experts and has not been read generally by those who assume to know something of the oil question. This bulletin was written by Mr. J. O. Lewis, then with the Bureau of Mines; later chief petroleum technologist; and now with Smith-Dunn, of Marietta, Ohio, who hold the patents to the so-called Smith-Dunn, or Marietta, process for forcing compressed air into the oil sand and drawing it out through adjacent wells. In this process the air takes the place of the gas, and has definitely established the fact that gas is the principal medium in bringing the oil to the well, and its production, depletion, or waste must be considered in arriving at the possible production and at least at the term of life of the flush production of oil wells.

"In considering the naval oil program—that is, the matter of the use of the naval royalty oils from the then production in reserves 1 and 2, and the use to be made thereof—the construction of storage therefore at strategic points and where the oil would not be wasted or lost but could be retained without fear of such loss above a fraction of 1 per cent for ten-year periods, it was mutually agreed between the Secretary of the Navy and the Secretary of the Interior that such program should be worked out first for such two reserves, and should not be extended to naval petroleum reserve No. 3, unless there was danger of loss to the Navy through drainage therefrom. The alarming conditions existing in the first two fields, as hereinbefore related, caused early attention, however, to be directed to the possibilities or probabilities of such drainage of the Teapot Dome, in naval reserve No. 3. . . .

"Mr. Heald [of the U. S. Geological Survey] states that—

" 'If appreciable loss becomes imminent, due to intensive drilling near the line, fractions (within the naval reserve) should be leased in the order given' (by him). And he concludes with the advice that no further leasing should be done. I am glad to send this report up in full, as attached hereto, as I understand that some parties have claimed that they had information it was of a very reassuring character, and that because of the advice given, no lease of any area in the Teapot Dome should have been made.

"The official of the Bureau of Mines representing the United States Government in this district is Mr. F. P. Tough, chief oil and gas supervisor, who has official representatives checking oils, supervising drilling, making tests, collecting royalties, etc., all residing in Wyoming, and who every day during the year are actively in the field in the performance of their duties. To Mr. Tough instructions were given prior to September, 1921, and through him instructions given his subordinates, to make careful examination into the probable drainage of the Teapot Dome, or petroleum reserve No. 3.

"Mr. Tough is a graduate of Columbia University in mining engineering, with a course of geology, and for six years was resident geologist for the oil properties of the Southern Pacific interests in California. The conclusion of the oil experts of the Bureau of Mines, communicated both in verbal and written memoranda reports to the Secretary of the Interior, was that much more grave and serious danger of

losses by drainage through outside drilling existed and exists than appeared to be understood by the Bureau or the Geological Survey. Their experience upon the ground was and is that where faults occur, as they do occur in the similar structure and in the identical sands supposed to underlie the Teapot Dome within the present producing area of the Salt Creek field, such faults have not interfered at all with drainage and they have not caused a sealing of one pool of oil from another or from encroaching waters. I herewith file, marked 'Exhibit I,' memorandum report made by Mr. Tough, which brings up to date information heretofore obtained from time to time during our investigation. Because of the actual facts stated as above experienced, particularly as to the wells drilled in the Salt Creek field and the water level in relation thereto, this report, even if it be considered as conflicting with the reports of geologists and others, would be almost conclusive.

"As has just been shown, the undeniable facts, in so far as human judgment can ascertain them from expert evidence and otherwise, are that at least a certain portion of the north part of the naval reserve No. 3—the Teapot Dome—is now, or will be, disastrously affected through drainage by the drilling upon the lands outside the reserve, which drilling is now being carried on from day to day. Such drilling upon such lands is in accordance with the terms of the law itself, and those conducting such operations are protected by the law. This being the case, it is necessary immediately, or it is practically admitted by everyone claiming to know anything of the conditions, that it will be necessary in a comparatively short period of time to protect such threatened area, and that the only feasible method of such protection is to cause drilling operations of offset wells and the consequent production of oil from the Teapot Dome.

"As shown herein, conditions are not similar in the Salt Creek field. It would become necessary either to add to the present overstocked oils by attempting to dispose of the oils so drawn from Teapot Dome in a market where competitive conditions do not exist, or to provide storage upon the ground for the same. Such storage would be a thousand miles from Los Angeles and 1,700 miles from Norfolk, with no method of transportation to either point, or any other seaport, except by transportation overland in tanks. In the next place, neither the Interior Department nor the Navy Department has any appropriations or funds which could be used or diverted for the construction of such storage. Therefore, the only possible method by which it could be handled would be to sell the oil for such price as it might bring. The only other alternative would be to allow the present owners or lessees of adjoining lands to drain this area and to use for their own purposes the oils obtained therefrom without compensation to the United States Government or to the Navy.

"Therefore, Mr. President, the Secretaries of the Navy and the Interior were, in attempting to formulate the proper administrative policy for the preservation of the interests of the Government in the oils of petroleum reserve No. 3, the Teapot Dome, at the beginning of the year confronted with these conditions, to wit: First, that by deferring productive drilling in naval reserves Nos. 1 and 2 in California great and irreparable losses had been incurred through the drainage of the governmental land by wells drilled upon privately owned or privately held lands; second, that serious, and as we believed immediate danger of material losses to the Government was impending through the drainage of an area approximately at least 2,000 acres out of naval petroleum reserve No. 3; third, that in the event of an attempt to protect by drilling offset wells in petroleum reserve No. 3 such production could not be effective because of the geographical and commercial conditions existing in the Salt Creek field, as hereinbefore set forth. We realized that conditions were entirely different, as I have explained, in the California and Wyoming fields. In the one, to reiterate, we had competitive bidding, competitive prices, competitive pipe lines, and water communication through such pipe lines. In the other, Wyoming, no competitive bidding, a geographical monopoly, no pipe line except to a railroad, and that of insufficient capacity to convey the then daily production by 50 per cent of the total being produced, no pipe lines from the railroad, no pipe lines to the water, and no possibility of the Navy using the oils except through the sale in such restricted and non-competitive markets, with the proceeds to the miscellaneous fund, or some exchange to be worked out based upon the low price of the crude oils in the Salt Creek field and the acquisition of naval fuel oils when needed.

"The final conclusion of this matter, after almost continuous consultation between the Navy and the Interior Departments, was the formulation of a skeleton contract setting out the royalties which would be required, the exchange provisions and others, and containing practically the identical terms as finally embodied in the signed and executed contract now held by the Mammoth Oil Co. The details, however, were under consideration for many days, and consultation with other independent oil companies and their representatives were proceeding in the meantime. When attention was called to certain provisions with reference to pipe lines and connections, particularly frank statements were made by such representatives of well-known financial ability, that although they could finance the proposition without difficulty, they could not enter into exchange transportation agreements such as were finally demanded and to which Mr. Sinclair acceded. The royalties offered by Mr. Sinclair were more than those offered by either or any other party during these discussions."

Oil Production Decreases Except in California

The petroleum situation is discussed under date of June 1, by the Federal Reserve Board in its survey of business, as follows:

Production of crude petroleum during April decreased considerably for the country as a whole. This was especially noticeable in District No. 11 (Dallas, Tex.). In this district crude petroleum production, which reached a peak during March, declined sharply, and only 13,750,590 bbl. was produced, a decrease of 2,496,090 bbl. This large reduction was due partly to the unfavorable weather conditions and partly to the low production of new wells completed. Both the Louisiana and Texas fields shared in this reduction, the April daily average yield for all Texas fields being 349,713 bbl., against a daily average flow of 389,944 bbl. during March. District No. 12 (San Francisco) again reports increased production, and a decrease in consumption, resulting in the largest stored stocks of crude petroleum since April, 1917.

Average daily production in California during April was 341,077 bbl., compared with 333,737 bbl. in March and 338,981 bbl. in April, 1921. Forty producing wells were completed during the month. Stored stocks of gasoline held in California decreased 12,693,835 gal. during March and stood at 63,718,701 gal. on April 1, compared with 51,573,945 gal. on April 1, 1921.

An estimate of the crude oil production in Distict No. 10 (Kansas City) indicates a decrease when compared with March, but an increase when compared with April last year. In that district there was an increase in the number of wells completed, and the daily new production was 7,107 bbl. less than in March, but more than double the daily new production during the corresponding period a year ago.

No radical price changes have been noted in any of these districts for crude oil. Refiners report a general improvement in the situation, with the increasing demand for gasoline. As the season has advanced increases of from 2c. to 2½c. per gallon have been made.

MEN YOU SHOULD KNOW ABOUT

W. J. Loring has returned to San Francisco.

G. L. Sheldon, of Denver, Col., has gone to Fuerte, Sinaloa, Mexico.

Eugene B. Braden has returned from New York to San Francisco.

R. C. Moore is doing geological work on the Kaiparowits Plateau, in Utah.

Thomas H. Leggett has returned to New York from a journey to Nevada and Utah.

T. A. Rickard returned to San Francisco last week from a visit to Santa Rita, N. M., and Denver, Col.

A. I. D'Arcy, mine operator of Goldfield, Nev., has returned to Goldfield after an absence of two months.

L. F. S. Holland is examining mines in central Oregon. He expects to return to Hollywood, Cal., about the middle of June.

John V. W. Reynders, a director of the A. I. M. E., addressed the local section of the Institute in San Francisco on June 5.

W. W. Wishon has been appointed consulting engineer to the Katherine Big Four Mining Corporation, operating at Kingman, Ariz.

J. H. M. Shaw, director of the Exploration Company, sailed to London from New York on June 13, on his return from El Oro, Mexico.

Major J. M. Campbell, of Middlesboro, England, made a tour of inspection of the mines and open pits on the Mesabi iron range last week.

John A. Anderson has gone to Overland Canyon, Tooele County, Utah, to do prospecting work. He expects to remain there until September.

D. D. Muir, Jr., in charge of the Salt Lake City office of the U. S. Smelting, Refining & Mining Co., was in San Francisco early in June.

C. D. Avery, of the U. S. Geological Survey, has returned from a visit to the Moorcroft, Wakeham, Thornton, Osage, and Newcastle oil districts.

J. D. Northrop is in New Mexico making a special examination on the east side of the San Juan Basin in connection with coal leasing work.

Luther B. Eames, formerly with the Goldfield Consolidated and Hollinger companies, is now with the Stearns-Roger Manufacturing Co., of Denver.

A. H. Brooks, in charge of the Alaskan division of the U. S. Geological Survey, is en route to Alaska with the party of **C. H. Huston,** the Assistant Secretary of Commerce.

Stanly A. Easton, manager of Bunker Hill & Sullivan Mining & Concentrating Co., spent a few days at the home office of the company in San Francisco, early in June.

C. H. Abeling, mill superintendent for the Vipont Silver Mining Co., at Vipont, Utah, is making a visit to Boise, Idaho, Spokane, Wash., and the Cœur D'Alene mining district.

Prof. Frederick W. Sperr, with a party of forty-two students from the Michigan College of Mines, spent two weeks recently on the Gogebic Range studying mining methods and equipment.

F. A. Wildes, state superintendent of mines, recently visited the Mesabi iron range on one of his inspection trips. The trip included the operations and plant of the Mesabi Iron Co. at Babbitt, Minn.

H. I. Altshuler, formerly with the Cerro de Pasco Copper Corporation, at Cerro de Pasco, Peru, is now at Tayoltita, Distrito de San Dimas, Dgo., Mexico. Mr. Altshuler was recently in San Francisco.

Major Yuill, mining engineer, of London, England, has arrived in Canada and is on his way to Lake Chibougamou, Quebec, to examine the mineral deposits there in the interests of a group of British financiers.

Dr. Frank D. Adams, professor of geology and dean of the faculty of applied science at McGill University, Montreal, has been appointed chairman of the Canadian Advisory Council for Scientific and Industrial Research.

John G. Barry, consulting mining geologist, has recently completed some examinations in the Santa Eulalia camp, and has proceeded to the Santa Barbara and Parral districts of Chihuahua, Mexico, on additional work.

James F. Callbreath, Secretary of the American Mining Congress, arrived in Denver on June 12, and will remain to complete arrangements for the Western Mining Conference which will be held there June 20 and 21.

In recognition of his services in developing metal research in this country, **Dorsey A. Lyon,** chief metallurgist of the U. S. Bureau of Mines, has had conferred upon him the degree of Doctor of Science by the University of Utah.

Frank H. Blackwell, chief geologist and mining engineer of the McKinney Steel Co., and **Clarence D. Pitman,** mining engineer, have gone to the company's gold mine in Mexico. They will visit other southwestern properties, and Mr. Pitman will take up residence in El Paso.

H. L. F. Blake, mining engineer, of Ottawa, has gone on an exploring expedition to the Ungava district in Northern Quebec in charge of a party of British engineers, representing important English financial interests. The principal objective of the expedition is Lake Chibougamau, on the southern border of Ungava.

Sidney Paige, G. W. Stose and **Mrs. Knopf,** geologists in the services of the U. S. Geological Survey, left June 1 for a field conference in Pennsylvania to establish certain conclusions with regard to the Glenarm series. They were joined in the field by **Florence Bascom** and **Anna I. Jonas.** State Geologists **Ashley** and **Mathews** expected to participate in the review of the stratigraphy, with which both Pennsylvania and Maryland are concerned.

H. S. Mulliken, head of the new War Minerals Supply Division of the U. S. Bureau of Mines, Washington, D. C., is in New York on Wednesday and Thursday of each week, largely in connection with the co-operative Government work connected with the determination of prices obtained for major metals. He has offices in the Custom House in connection with the U. S. Bureau of Foreign and Domestic Commerce, Room 734, and may be addressed there.

F. G. Cottrell, formerly director of the U. S. Bureau of Mines, and until recently head of the Division of Chemistry and Chemical Technology of the National Research Council, has been selected for the directorship of the Fixed Nitrogen Research Laboratory, of the Department of Agriculture. He will succeed **Richard C. Tolman,** who has resigned to become professor of physical chemistry and mathematical physics at the California Institute of Technology at Pasadena. No decision has been made as to the exact date on which Dr. Tolman will turn over the work to Dr. Cottrell, but it probably will be late in the summer. Dr. Tolman's duties with the California Institute of Technology begin with the fall term.

Mining and metallurgical engineers visiting New York City last week included: **Charles F. Jackson,** of Cleveland, Ohio; **G. J. Kennedy,** of Easton, Pa.; **M. F. Sayre,** of Schenectady, N. Y.; **S. W. Harris,** of Silver City, N. M.; **S. A. Crandall,** of Kellogg, Idaho; **T. K. Muir,** of El Paso, Tex.; **W. M. Dake, Jr.,** of Denver, Col., and **A. J. Bartlett,** of Marytown, W. Va.

OBITUARY

H. W. Pridgeon, manager of the West Springs, Ltd., died April 19, at Johannesburg, South Africa. Mr. Pridgeon was for many years underground manager of the Brakpan Mines, and in 1916 was appointed manager of the Daggafontein gold mine. In 1919 he was transferred to West Springs.

James H. Pearce, aged seventy-four years, a leader in the development of the Minnesota iron ranges and one of the founders of the city of Chisholm, Minn., died at Minneapolis on June 3. Mr. Pearce came to the Minnesota iron ranges from Michigan thirty years ago as general manager of the Corrigan-McKinney interests. He was instrumental in opening up some of the first mines on the Mesabi range and was at one time associated in mining with **A. M. Chisholm** and **George H. Crosby,** of Duluth.

New Books

A Standard Work on Colloids Revised

Chemistry of Colloids. By W. W. Taylor. Longmans, Green & Co., New York. $3.50.

This is the second edition of an excellent treatise that appeared in 1915 and served to remind one that the development of colloid chemistry was not entirely due to German investigators. It has served as a concise textbook, and for reference by workers in other sciences who are interested in the subject. It treats primarily with the fundamental theories of colloidity, and it is interesting to note that the work done has been so thorough and so scientific that no radical changes of interpretation are noticeable in the new edition. The general arrangement has been maintained, the book being divided into four main divisions, dealing with the general properties of colloids, methods of preparation, surface phenomena and adsorption, and application of colloid chemistry.

Under osmotic pressure one notes reference to the work of Einstein, who maintains that osmotic work varies directly with the number of particles in unit volume. The subject of ultrafiltration is discussed at greater length, as is the action of electrolytes on emulsoids. Bachman's work on alcogels is quoted, and increased attention paid to the structure of gels, the author showing that there has been a return to the early theories of Frankenheim (1835) and Nägeli (1858). Little additional work has been done during late years on the preparation of colloids; the theories of adsorption are still unsatisfying and incomplete. The final chapters of the book deal lightly with the practical application of colloid chemistry, the author discussing dyeing, tanning, the soil, purification of sewage, and the application of colloid chemistry to biology.

The treatise is a scholarly attempt to discuss the fundamental principles underlying colloidal phenomena. It is creditably free from errors, technical and typographical, and will be recognized as one of the standard textbooks on the subject. A. W. A.

Two Commercial Directories

Industrial Directory and Shippers' Guide. Published by New York Central Lines, New York.

This book will be of interest to all who may have occasion to ship freight over any of the New York Central Ry. lines. It contains sketches of the industrial communities reached by the road, a directory of some 50,000 producers and manufacturers of almost every conceivable product, a large number of city and railroad maps, particulars of banks and trust companies and commercial organizations in the region covered, and much information of value to importers and exporters, all in a well-bound book of about 1,000 pages. The volume will be sent free of charge to those to whom it will prove useful.

Hendricks' Commercial Register, 1922. S. E. Hendricks Co., 70 Fifth Ave., New York. $12.50.

This is an exceedingly valuable book for those who want to know "who sells what," and it is constantly used in this office for answering inquiries as to names of producers, manufacturers, and dealers in all parts of the country. The classifications are the same as formerly: alphabetically by commodities; by individuals or companies; and by trade names.

Aluminum and Its Alloys. By C. Grard. Translated from the French by C. M. Philips and H. W. L. Phillips. D. Van Nostrand Co., New York. $5.

This book discusses the properties, thermal treatment, and industrial application of the metals mentioned in the title. Only six pages are devoted to winning the metal from its ores, so the book is chiefly of interest to present and prospective users of aluminum. The topics covered include physical, chemical, and mechanical properties; micrography, preservation, soldering, quenching, and casting. Much experimental work is illustrated by charts. The book is hardly large enough to be comprehensive, but contains much of value.

The Engineering Index, 1921. Published by The American Society of Mechanical Engineers, New York City. $6.

When we have occasion to look up a reference to an article published in the technical press, we instinctively turn to this book or to the Industrial Arts Index published by the H. W. Wilson Co. The Engineering Index is not so complete, omitting to catalog many articles which would hardly interest mechanical engineers, but it gives a brief absract which is often valuable. Over 14,000 articles are listed, which appeared in about 600 engineering and allied technical publications. A new volume is published each year, and the books are valuable to those who have need to look up the published literature on any engineering subject.

Coal Mining Costs. By A. T. Shurick. The McGraw-Hill Book Co., New York. $5.

Although metal miners are not usually particularly interested in coal mining, the two branches overlap at many points, and much data that apply to the one phase of mining activity are equally applicable to the other. The present book is the first to discuss coal-mining costs on a comprehensive scale. The various sections cover mining costs, shaft sinking, haulage costs, timbering costs, and miscellaneous inside costs, all the data applying to underground work. The metal miner will find much of interest.

Technical Papers

Uses of Copper and Zinc — The *Monthly Journal of the Utah Society of Engineeers* for February (Hugh C. Lewis, University Club, Salt Lake City, Utah; price, 25c.) contains an eleven-page article discussing briefly the principal ways in which copper and zinc are used and some of the specifications which the metals so used must meet. There is little that is new in the article, but it is a good compilation.

Thickness of Strata — Professional Paper 129-C issued by the U. S. Geological Survey, Washington, D. C., obtainable on request, describes the graphic and mechanical computation of thickness of strata and distance to a stratum. The paper gives a geometric solution, a trigonometric generalization, and simplified methods of computation.

Mining Accidents—Technical Paper 295, "Quarry Accidents in the United States During 1920," and Technical Paper 299, "Metal-Mine Accidents in the United States During 1920," are now available from the U. S. Bureau of Mines, Washington, D. C. The bulletins consist largely of tabulations, with accompanying explanations.

Magnesium — The *Electrician* for Jan. 27, 1922, has an article on the production of metallic magnesium, describing principally an electrolytic process to be used by the Magnesium Company in England. The article is reprinted in *Chemical and Metallurgical Engineering* for May 24, 1922. (New York, N. Y.; price, 25c.)

Anti-Corrosive Material for Tanks—Metallurgists who have acid solutions to handle are accustomed to having much trouble from deterioration of apparatus which comes in contact with the corrosive liquors. In the *Iron Trade Review* for April 6 is a six-page article "Why Pickling Tank Rods Corrode," which describes a series of experiments conducted on various acid-resisting materials used in tank construction and suggests means for minimizing acid attack. Monel metal seems to have much to commend it for such uses. Reprints of the article may be secured free of charge from the International Nickel Co., 67 Wall St., New York City.

Hydraulic Calculator for the Solution of Water Problems in Canals, Flumes, Culverts, Pipe Lines, Etc. Devised and for sale by J. R. Jahn, Berkeley, Cal. Diagrams are accompanied by flexible transparent straight-edge and an eight-page pamphlet of directions.

A nomographic chart for the purposes stated above and for various other calculations incident to irrigation, water power, and water supply, including pumping plants, weirs and earthwork estimates. Values for n in open and closed conduits and for v in open canals are suggested.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

TESTIMONY by Horace V. Winchell on the proposed revision of the mining law was an interesting feature of the hearing before the Committee on Mines and Mining on June 8. It developed that Secretary Fall is opposed to any radical change.

International Nickel will resume work at its mine and smelter on Sept. 1, it has been definitely announced.

The Denison "Blue-Sky" bill will not be considered at this session, on account of the large amount of other legislation pending.

Increasing scarcity of skilled labor is reported from various mining districts.

Mining in the State of Washington is now about a third of normal, according to a review in this issue.

A consular report from Mexico states that money is scarce there and that some mining companies are having difficulties in securing needed funds.

Activity continues in the Porcupine district. Dome has taken an option on the Foley-O'Brien, and a rumor is in circulation concerning the sale of the Schumacher.

Iron Ore Freight Rates Ordered Reduced

Interstate Commerce Commission Rules for 10 Per Cent Cut from Northern Ranges to Lake Docks

A 10-per cent reduction in freight rates on iron ore from points in Minnesota, Wisconsin, and Michigan to upper Lake ports, effective July 1, 1922, has been ordered by the Interstate Commerce Commission. In announcing this reduction the commission says its recent order making general rate reductions did not apply to ore from these districts. In justification for the reduction the commission says that since August, 1920, none of the rates on iron ore to upper Lake ports have been reduced, while some have been increased. Under the new order the rates after July 1 will be 90 per cent of existing rates on iron ore from Minnesota, Wisconsin, and Michigan to upper Lake ports.

When the commission made its general rate advance in August, 1920, rates on iron ore north of the Lakes were not increased because they had previously been subject to a special increase by the director general of railroads of about 57 per cent.

The commission's order will not affect the U. S. Steel Corporation, it is said, which moves most of its ore from the ranges to the docks over its own rails. The company's railroad earnings will be cut, but so will its book costs of ore. Independents, however, taking ore from the ranges are benefited by the order at the expense of the railroads handling the ore.

The Duluth, Missabe & Northern and the Duluth & Iron Range roads had already announced a voluntary cut of 10c. to 90c. on ore from mine to docks, effective July 1.

Alexander's Estate Awarded Engineer Mine

The Engineer mine, at Atlin, B. C., belongs to the estate of Captain James Alexander, according to a ruling of the Appeal Court at Victoria on June 6. The property had been relocated in 1907 by Captain Alexander, wrongfully so, it was alleged, by the original locators. After the "Princess Sophia" sank, with Alexander on board, the property passed to Allan I. Smith, of Philadelphia, to whom Alexander had willed it. Smith has since died and the mine will thus go to his estate.

Large Radio Receiving Set for Mining Camp

One of the largest inland radio receiving sets in the country is being installed at the Standard Camp of the Standard Chemical Co. in Montrose County, Colorado. The receiving station will be able to pick up messages from any sending station in the United States. The Standard Chemical Co. is the largest producer of radium-bearing ores in the country, and the plant has been installed by the company for the benefit of its employees.

International Nickel to Resume

The International Nickel Co. will resume work on a small scale at its Creighton mine, in the Sudbury district, Ontario, on Sept. 1. Two blast furnaces at Copper Cliff will be blown in at the same time.

All of the bessemer matte produced will be shipped to the new Port Colborne refinery. The old refinery at Bayonne, N. J., is being dismantled. The new rolling mill at Huntington, W. Va., is expected to be ready for operation during the summer.

Shasta Zinc & Copper Co. to Start Smelting

The Shasta Zinc & Copper Co., of Winthrop, Cal., recently started to fire its large reverberatory. It was expected that it would take about a week to heat it, when smelting would begin. Zinc ore is being hauled from the Star mine. The refinery addition is almost completed. The company will manufacture zinc oxide.

Second Fire at Manhattan, Nev.

The mining town of Manhattan, Nev., which suffered a $75,000 fire on May 26, was again visited by fire on June 3. The loss is estimated at $30,000. The business district was practically wiped out as was a part of the residential section.

Callahan Zinc-Lead to Increase Capital Stock

The directors of the Callahan Zinc-Lead Co. voted June 5 to increase the capitalization from 500,000 to 1,000,000 shares. Stockholders are to be given the right to subscribe to part of the new issue in an amount and at a price to be announced after the increase has been authorized at a special stockholders' meeting to be held on July 24.

The proceeds of the new financing are to be used for the acquisition, development and equipment of new properties. It is understood that the stock will not be issued except as required for this purpose. The condition of the treasury is excellent, with sufficient cash on hand for more than three years' requirements on a basis of present maintenance operations. The company has no indebtedness aside from current accounts payable.

No decision has been made as to the date when operation will be resumed. The announced reduction in freight rates will greatly benefit Callahan, as its concentrates are subject to a long haul to points east of the Mississippi. This in conjunction with the improved market for lead and zinc is thought to make the outlook brighter.

The high-grade ore recently cut on the No. 6 tunnel level of the Galena Mining Co., of whose stock the Callahan company owns 62 per cent, still holds up in grade. The heading is now in about 95 ft.

Dome Takes Option on Foley-O'Brien

An option has been taken by Dome Mines, Ltd., of Porcupine, Ont., on the Foley-O'Brien property, which lies east of the Dome Extension. Considerable work was done on it some years ago, and low-grade ore was opened up, which is believed to be on the extension of the Dome ore zone. It is understood that the option extends over a period of several years, and that the purchase price is for exchange of Dome shares, although the terms have not been disclosed.

Schumacher Property at Porcupine Reported Sold

There are a good many rumors to the effect that the property of the Schumacher Gold Mines, Ltd., adjoining the Hollinger, at Porcupine, Ont., has been sold. The company has 1,850,000 shares outstanding, of which F. W. Schumacher controls 1,300,000, and it is understood that he is holding them for $1 per share. The property is equipped with a mill, which treated 112,000 tons of ore, giving a production of $561,885.

Iron Ore Exported to Germany

By Reuters Agency

Madrid, May 26.—According to news from Melilla, the Cia. Española de las Minas del Riff has exported to Germany since May 1 nearly 30,000 tons of iron ore and is to export a further quantity of 45,000 tons. All the ore is intended for Westphalian works.

Plan to Reorganize New Idria Quicksilver Mining Co.

Reorganization of the New Idria Quicksilver Mining Co. as the New Idria Quicksilver Mines, Inc., is planned. The former has been in the hands of a receiver for the last eighteen months. Under the plan the new company will issue $125,000 ten-year 7-per cent mortgage bonds, 30,000 shares of 8-per cent non-cumulative preferred stock, of $10 par value, and 35,000 shares of common stock of no par value. The bonds will be secured by the entire property of the company, together with its claim against the American & British Manufacturing Co. A verdict in this suit has already been received by the New Idria, but the case is still in the courts. Retirement of the bonds is to be provided for by a sinking fund, into which will be paid at least half of the annual net earnings.

Creditors of the New Idria company will receive $125,000 in bonds, 10,000 shares of common and the same amount of preferred stock. The company owes them about $225,000.

The present shareholders will be allowed to subscribe for 20,000 shares of the new company's preferred stock in proportion of one share of new preferred plus a bonus of one share of common for five shares of old plus $10 cash. Subscribers must make their first payment by July 1, 1922, to have any interest in the reorganized company. The remaining 5,000 shares are reserved for the use of the managers in meeting reorganization expenses, any balance to be held in the treasury.

Professional Engineer's Bill Amended

Ontario's Professional Engineer's bill, in a greatly emasculated form, has passed through the committee, and is ready for the Legislature. As the bill now stands all engineers have the right to organize into a "Professional Engineers' Association" and to protect the title "Professional Engineer," but they have no special rights in respect to work of an engineering character, which was the chief feature of the bill as originally drafted.

Gold Output Figures Reported

By Cable from Reuters to "Engineering and Mining Journal-Press."

London, June 12—The gold output in India during May totaled 32,527 oz.

The production of gold in West Australia in May amounted to 39,725 oz.

The output of gold in New South Wales during the first five months of 1922 totaled 13,379 oz.

Ewert May Ask Rehearing in Zinc Land Case

The U. S. Supreme Court has stayed its mandate in the recent decision nullifying the purchase of Indian zinc lands by Paul A. Ewert on the ground that as a Government officer he was ineligible to make the purchase. This action is to permit Ewert to file a petition for a rehearing of the case within sixty days.

News from Washington

By PAUL WOOTON
Special Correspondent

Winchell Testifies at Hearing on Mine Law Revision

Prospector's Day Almost Over, He Says —Fall Opposed to Radical Change in Present Statute

Much of the opposition to the proposed revision of the mining laws is coming from the prospector and his friends. This opinion was expressed to the Committee on Mines and Mining on June 8, by Horace V. Winchell, who, as a member of the Ingalls committee which drafted the bill now before the Committee on Mines and Mining, appeared in support of the measure. He pointed out with particular clearness that the day of the prospector is almost over. Little can be done to restore the prosperity he once enjoyed, owing to the fact that the mineral deposits which can be located from surface indications have been taken up. Mr. Winchell pointed out that this condition does not apply to Alaska, but most of the area in the mineralized sections of continental United States have been gone over so thoroughly as to limit greatly the opportunities of prospecting in the old-time way. Prospecting, he pointed out, is becoming more and more a matter of large expenditure and is based on geological and engineering data, rather than on surface outcrops.

Mr. Winchell made a painstaking explanation of the various features of the bill and explained the good which he believes would come to the mining industry were the laws revised. Despite his convincing arguments, however, it is apparent that the Committee on Mines and Mining is far from being enthusiastic about the bill. This also applies to Representative Rhodes, the chairman of the committee, on whose initiative the legislation, to a great extent, depends. The attitude of the chairman and of several members of the committee may be explained in part by the views entertained by the Secretary of the Interior.

It was revealed at the hearing that Secretary Fall is inclined to the opinion "that it would be inadvisable at this time to pass a law radically changing the general laws now in effect." Secretary Fall, who has been a prospector himself, and who has had extended mining experience in the United States, where the apex law has applied, and in Mexico where vertical side lines govern, believes that as the laws relating to the disposition of metalliferous minerals have been in effect for more than fifty years, during which time they have been interpreted by rulings of the courts and of Government departments, it would be unwise to create confusion in the vested rights represented by the thousands of mining claims which have been located under the existing laws. It is his opinion that minor modifica-

tions may be suggested from time to time to cure existing defects, and it is his view that such a course would be much better than the one proposed that involves a general revision of the mining laws.

Secretary Fall does not want to be understood as being opposed to all revision. He admits that legislation dealing with metalliferous mining has been disjointed and disconnected. He thinks, however, that these laws could be brought into more comprehensive form without changing the general provisions under which the mining industry has been conducted and which have been construed so thoroughly by the courts. He also calls attention to the fact that, with the exception of the placer claims for non-metalliferous minerals, the law with reference to placer locations practically is superseded by the provisions of the general leasing law of 1920.

If the Committee on Mines and Mining will indicate its belief that the time has come to abolish the apex law and to revise other of the mining statutes, Secretary Fall states that he will be more than willing to give the entire matter personal consideration, and bring to the assistance of the committee the specialists on mining law serving with his department. He points out, however, that unless Congress is ready to adopt vertical side lines for mining claims, there would be no advantage in requiring locations in quadrangular form and making certain of the other amendments suggested in the bill now before the committee.

H. G. Moulton, of New York, explained that the form of the present bill could be changed so as to be less objectionable to the prospector. He urged the early revision of the mining code along the general lines of the present bill. He said it would be in the interest of the entire mining industry. In expressing these views, he stated that he fully understands the prospector's point of view, as his father was a prospector and that he himself had spent much time in the field searching for promising indications of mineralization.

No date was set for the next hearing of the series.

Further Action in Red River Placer Claims Case

Following its recent decision denying placer mining claims in Oklahoma in the Red River bed, the U. S. Supreme Court has issued a mandate denying the claims of all those who are asserting rights in the river bed based on placer mining locations.

To meet the Supreme Court's decision, Senator Nicholson, of Colorado, and Representative Newton, of Minnesota, have introduced bills to authorize the Interior Department to lease to persons and corporations land in Tillman and Cotton counties, Okla., belonging to the Government, which were prior to Feb. 25, 1920, claimed in good faith under the placer mining laws.

Advises Wildcatting for Potash in Texas

As a result of the establishment of the fact that potash is widely distributed in the red beds of the Southwest, the U. S. Geological Survey is trying to convince prospectors that wildcatting for potash should accompany wildcatting for oil in that region. The extra cost of drilling so as to recover cores is amply justified, it is contended. Some wells are now going down where the primary purpose is to prospect for potash. The Pennsylvania Oil Co., Lancaster, Pa., has contracted for the sinking of five wells in Ector and Crane counties of Texas. The contract provides for the cutting of cores. Another oil company has announced its intention of cutting cores in three counties.

Many War Minerals Claims Disallowed

Four Awards Made Subject to Secretary Fall's Approval

Subject to the approval of the Secretary of the Interior awards have been recommended by the War Minerals Relief Commissioner as follows: Shelby J. Gish, Big Timber, Mont., $5,436.25; Duckworth & Meadows, Sumpter, Ore., $1,074.09; G. A. St. Clair, Duluth, Minn., $7,724.05.

Disallowances and the commissioners' reasons therefor have been recommended as follows:

Salt Lake Tungstonia Mines Co., Preston, Idaho, stimulation not established; Harry W. Boynton, San Francisco, no request or demand; Thomas Bessler, Jr., Sumpter, Ore., stimulation not established; Altshuler & Berger, San Francisco, no additional award justified; The Matchless Tungsten Mining Co., Denver, not commercial; Rare Metals Production Co., Denver, no request or demand; Andrew Mandoli, Anaconda, Mont., not commercial; Rare Metals Ore Co., Denver, stimulation not established; Butte Central Mining & Milling Co., Boston, Mass., no additional award justified; Alexander Caldwell, Benmore, Utah, stimulation not established; Dibblee & Arata, San Luis Obispo, Calif., no net loss established; Casey, Brown & Saunders, Batesville, Ark., not commercial; Sulphur Gulch Manganese Mines, San Francisco, not within the act; James T. Dobbins, Salt Lake City, decision of former commission approved; Joan Mining Co., Duluth, Minn., stimulation not established; Manganese Products Co., Immodesto, Calif., not commercial; Boulder River Chrome Co., Great Falls, Mont., no additional award justified; Arata & Palmer, San Luis Obispo, Calif., recommendation of former commission approved.

Government's Silver Purchases

Purchases of silver by the Bureau of the Mint during the week ended June 10 amounted to 1,955,000 fine ounces. This brings the total purchases under the Pittman Act to 114,178,756 fine ounces.

Tariff Paragraph on Potash Faces Fight

Arsenic Amendment Adopted—Duties on Cadmium and Bismuth Remain

It is becoming apparent that the duties on potash will not be accepted by the Senate without a fight. Propaganda against the duties is afoot, and farmers in large numbers are writing to their Senators asking that they oppose the duty.

Those favoring the potash duty were encouraged greatly by the action taken by the Senate on manganese. A new element has been interposed in the situation by the promising discoveries of potash in Texas. The farmers and business men in southwestern Texas are acting in a united and active manner in their support of the potash duty. Each member of the Senate and of the House of Representatives has been mailed a brief signed by "owners of potash beds in the State of Texas," in which the point is made that foreign producers have effected an international combination in restraint of trade and that the consumers in the United States will suffer in the end unless American sources of potash are developed.

With the understanding that further discussion of the proposed duties on white arsenic and metallic arsenic will come up again when the free list is reached, the Democrats allowed the committee amendment making metallic arsenic dutiable at 6c. a pound to be adopted without a rollcall. With white arsenic dutiable at 2c. a pound, a compensatory duty of 3½c. additional would be required to accord the same treatment to metallic arsenic. The additional ½c. represents the protection which would be accorded the conversion process.

No serious objection was offered to the proposed duties on cadmium, bismuth, German silver, and gold leaf, and they were adopted on June 10 by the Senate. The duty on cadmium was fixed at 15c. a pound, although it was opposed by Senator Simmons, of North Carolina, who stated that it is a by-product of zinc ore and consequently does not require a duty. He admitted, however, that the rate is low and did not press his objection. The duty on bismuth was fixed at 7½ per cent ad valorem.

Transportation Institute to Be Organized

Organization in the near future of a National Transportation Institute is practically assured. Though no date has been set for the organization meeting, it will be held before the end of the summer. Bird M. Robinson, the president of the American Short Line Railroad Association, and his associates, who are doing the active work of promotion, are engaged at present in lining up such support as will insure the new organization having a representative backing.

News by Mining Districts

London Letter

Knox & Allen Report on San Francisco Mines—Selukwe Company's Interest in British Columbia

BY W. A. DOMAN

London, June 2.—Shareholders in the San Francisco Mines of Mexico who put their capital in the original company have had a long time to wait for any tangible results, but it appears as though their patience will at last be rewarded. Not that there is any possibility of a dividend yet, so far as I can see. The hope that shareholders can now entertain lies in the fact that the Union Corporation, which has subscribed a large sum of money to open up the property and win the metals, has settled down to work with a right good will. It is not at all unlikely that dividends will be distributed in due course, but the issue of debentures must not be overlooked, and the further fact that unpaid interest exceeded £103,000 at the date of the balance sheet, Sept. 30 last. That, perhaps, is the dark side from the shareholders' standpoint. The brighter side is to be found in the report of the consulting engineers, Knox & Allen.

Difficulties were met in the way of labor, and development has fallen behind. The result is that so far as ore reserves proper are concerned, there are virtually none. This position is to be remedied, and at least two years' reserves are to be opened up. During the period covered by the report, the estimated quantity of sulphide ore developed was 91,940 tons, of which 41,000 tons was on the fourth level and above, and 50,940 tons on the fifth level. The ore on the fourth level runs 1.59 g. gold; 561 g. silver; 13.2 per cent lead; and 19.5 per cent zinc. That on the fifth runs 507 g. silver; 12.64 per cent lead; and 19 per cent zinc.

Values on the fifth level are rather inferior to those on the fourth, the explanation given being that the lower level has not been sampled to the face, and that the part sampled from which the above grade is averaged is lower than the section into which it is now entering. The new mill for concentrating the sulphide ore has a capacity of 275 tons daily, and it is so constructed that it can, without difficulty, be easily doubled. Knox & Allen assume that each 100 tons will be composed of 32 tons of lead concentrates, and 68 tons of lead residues, from which recovery is expected as follows: Lead concentrates: silver, 72 per cent, lead 91 per cent, zinc, 32 per cent. Lead residues: silver 28 per cent, lead 9 per cent, zinc, 68 per cent.

With lead at £24.375 per long ton, and with exchange $4.13, the return per ton of crude ore should be $12.22, and costs at 90,000 tons per annum are expected to be $4 per ton.

The Selukwe Gold Mining & Finance Co., which originally dealt mainly with Rhodesian properties, has acquired a substantial interest in the British Canadian Silver Corporation. The capital of the corporation is £400,000 in 1,600,000 shares of 5s. each, and the Selukwe now has one million shares, or about 62.6 per cent. The main attraction seems to be the situation of the company's property, which adjoins the Premier gold mine, in British Columbia.

NORWAY

Kongsberg Mines Make Important Connection Underground

The total silver production from the Kongsberg mines, Norway, during March, was 3,823 kg. There were festivities in town and camp on May 10 when the break through between the Christian and Underberg levels took place and linked up the Overberg and Underberg sections from Postleromoen to Laggraenden—a distance of about seven kilometers. The work has been in progress for four years, and the economic results of the connection, both in labor and transport, are expected to be considerable. This, with the reported new find in Hans Sachsen mine (of which further particulars are awaited from the state surveyor of mines) would seem to have brought a new era of Kongsberg prosperity within reasonable perspective.

QUEENSLAND

Tin Mining Active in Herberton District—Mount Morgan Loses Income Tax Appeal

From Our Special Correspondent.

Brisbane, May 1, 1922—Despite the existing stagnation in mining, a good deal of work is still being done in the tin mines of the Herberton district, inland from Cairns in the Far North. Though from the lower-grade propositions the ore taken is being stocked awaiting a better market, the holders of the richer mines, especially those near Herberton, are able to continue operations and realize upon their ores at a profit, even at present market prices. In the Herberton district the mines giving the best yields are, in the order named, the New Bradlaugh, which last year produced 5,447 tons of ore; the old Vulcan mine, at Irvinebank, 2,727 tons; the Arbouin, 2,231 tons; and the You and Me, 2,081 tons. The Vulcan, which in the past from workings to a depth of 1,400 ft. made exceedingly profitable returns, was reopened some time ago. Although this company's efforts, carried out in the deeper parts, were disappointing, some tributers, working at the 600 level, got fair supplies of rich ore. The tin mines in this district, as well as those in the vicinity of the Sardine mine, in the Kangaroo Hills district, further south, hold much promise for the future when market prices improve.

The March sales of gold through the Gold Producers' Association, including local sales for the first quarter, were only 9,064 oz. of standard gold, the average net price realized being £4 11s. 6d. per standard oz., equal to £5 5s. 3d. per oz. fine. A distribution of £13,491, or 7.28d. per oz., representing the unexpended balance of moneys set aside at June 30, 1921, for adjustments and contingencies, was made on April 8.

In connection with the distributions of the Gold Producers' Association, important decisions have recently been given by the courts against the Mount Morgan company and another gold-mining company operating in the south on appeals by those companies against their being charged with income tax on premiums received through the association from sales of gold abroad. The companies contended that as the amounts received through the association did not come from income derived within the state, or earned in the state, they were exempt from taxation. The view of the judges, however, was that the source whence the income was derived was from mines in the states, and that the premiums received by the companies came from gold taken from their mines and were therefore taxable. It is probable that there will be an appeal from these decisions to the Privy Council.

Under the authority of an act of Parliament passed last session, the government, in order to assist in the working of the Chillagoe State smelters, has exercised an option which it held to purchase certain mines in the Mungana district near those smelters. The purchase price is £40,000.

BRITISH COLUMBIA

Northern Light Group Bonded to Premier—Big Missouri Under Option

Stewart—The Premier Gold Mining Co. has taken a three-year option on the Northern Light group from Charles and William Bunting. The consideration is $125,000, and a cash deposit of $5,000 has been made. The property consists of eight full claims and two fractions, which are situated immediately north of the Premier company's present holdings. It was bonded to the Algunican Development Co. in 1920, and a considerable amount of diamond drilling was done, but the bond was relinquished when the Algunican company got into financial difficulties.

A. B. Trites, of Fernie, and New York associates have taken an option on the Big Missouri, at the head of Salmon River. This property was under option for some time to Donald Mann and associates, and after a considerable amount of diamond drilling and some tunneling and surface stripping and trenching were done, the option was relinquished on account of the inaccessibility of the property.

The Daly Alaska Mining Co. has started development work on the New

Alaska, under the supervision of Pat Daly.

Trail—A $7,500,000 issue of 7-per cent convertible bonds was authorized at a special meeting of the shareholders of the Consolidated Mining & Smelting Co., in Montreal on May 30. Only $6,000,000 will be issued at first. The debentures mature on July 1, 1942, and may be exchanged for fully paid shares in the capital stock of the company. One million dollars of the issue will be used for the construction of the first unit of the concentrator for the Sullivan mine.

Ore shipments received at the Consolidated's smelter May 22 to May 31, inclusive, totaled 13,495 tons, of which 12,530 tons came from company mines. Other shippers were: Black Rock, Northport, Wash., 72; Mountain Chief, West Robson, B. C., 130; Quilp, Republic, Wash., 103; Rambler Cariboo, Rambler Siding, B. C., 28; Surprise, Republic, Wash., 222; Silversmith, Sandon, B. C., 367, and Spokane Trinket, Ainsworth, B. C., 43.

The special plant of the Consolidated Mining & Smelting Co. for handling custom zinc ores was ready for operation on May 31, and the company has announced that it will now accept that class of ore for treatment. On account of the accumulation of such ores at a number of properties, notice has been given operators that tonnage can only be taken on allotment for a time.

Proctor—The Ivy Fern mine, which was under option to the Consolidated M. & S. Co., and which option was relinquished by that company a short time ago, is being further developed by Standard Silver-Lead Mining Co. In the event of favorable results following this work, it is likely that the property will be acquired by the Standard people.

Silverton—The old Standard mine which has been under option to interests represented by Clarence Cunningham, has disclosed nothing of importance as a result of the work so far done, according to a report issued recently by the Standard Silver-Lead Co.

Sandon—Resumption of payment of dividends by the Silversmith Mines is set for June, according to unofficial sources. The first disbursement will be 1 cent per share, and subsequent profit disbursement will likely be on a basis of 2c. per share quarterly.

Ainsworth—All leases held by miners on the Florence mine were terminated June 1. It is anticipated that both mine and mill will be operating on company account by July 1, employing about eighty men.

Salmo—On the Bayonne group, in the Bayonne district, east of Salmo, satisfactory indications have been found at depth. The property is under option to Spokane interests, including John B. White, president of Silversmith Mines. As a result a syndicate has been formed in Nelson, which will amalgamate a number of groups of claims for development purposes.

ONTARIO

Vipond in Need of Funds—West Dome and Dome Lake Merger To Be Ratified—Noranda Mines, Ltd., Organized

Cobalt—The government is arranging to build a road to the Oxford-Cobalt mine, and as soon as this is done work on the property will be resumed.

The winze on the A-53 property, in Gillies Limit, is down to the 100 level, and it is understood that good ore has been cut.

The Coniagas, which has taken an option on the Brookbank claims in the Matchewan district, has let a contract for the diamond drilling of the property.

The Mining Corporation is meeting with excellent results in the development of the Haileybury Frontier property in South Lorraine.

During the week ended June 2, the only shipments from Cobalt were two cars from the O'Brien, with a total weight of 128,000 lb.

Porcupine—An examination of the Davidson property has recently been made by New York engineers, representing South African mining interests.

The directors of the Vipond have appointed a committee of four to devise means of getting an additional sum of money, estimated at $200,000, which is considered necessary to fully equip and develop the property and put it on a paying basis. It is understood that the cash on hand will not carry development work beyond July.

Shareholders of the West Dome and Dome Lake met in Toronto June 15 to ratify an agreement of amalgamation of the two properties. The new company, called the Consolidated West Dome Lake Mines, Ltd., will be formed, with a capitalization of 5,000,000 shares of $1 par, of which 1,500,000 shares will be issued to each company. In addition, Dome Lake receives 250,000 shares of treasury stock as payment for its mill and plant, and this stock will be used to retire the bonds. Underwriting arrangements for the treasury shares are being consummated.

Kirkland Lake—The Noranda Mines, Ltd., is a new company with a capitalization of 500,000 shares of $1 par value, which has been formed by Thompson and Chadbourne, of New York, to develop a large number of claims which they have been acquiring in the Kirkland Lake section. It is understood that the company has acquired, under option or by staking, about sixty claims, which include fifty claims in Gauthier Township, a block east of the Tough-Oakes, in Kirkland, and the United Kirkland lying to the west of the Teck-Hughes and Kirkland Lake Mines. Included in the Gauthier claims is the Elkstone-Dunkin property, on which promising discoveries are reported to have been made.

The Matachewan Gold Mines, which has recently been reorganized, is preparing to resume work. Steam power will be used temporarily.

WASHINGTON

Mining Industry in State About 30 Per Cent of Normal

Mining in Washington has not in the last twenty years reached such a low ebb as during the winter just passed. Three months ago practically no production was being made. During the last two months the slow betterment of the metals and the passing of a severe winter have put heart into the operators and the shipments now total from 1,500 to 2,000 tons monthly. This is chiefly crude ore, but several concentrators will likely resume before summer is over.

On June 1 about ten companies were producing regularly. These shipments are going to the Tacoma, Trail, and Bunker Hill smelters.

The industry is functioning at about 30 per cent normal capacity. Three mines in the Republic district are shipping siliceous gold ore to Trail. The Washington Black Rock Mine, at Northport, is regularly shipping high-grade zinc ore. The Electric Point and Gladstone of the same district are shipping lead ore to the Bunker Hill smelter. Silver production is coming from the Pyrargyrite at Nighthawk, the Old Dominion, at Colville, and the United Silver-Copper, at Chewelah. This last named company is also making a small copper production.

There are a large number of small properties under development. The general feeling is that better days are just ahead, and if the metal market continues upward it will be answered by an increased production from this state. The labor supply for the metal mines is plentiful.

The Tacoma smelter is operating at about 50 per cent of normal capacity. The Northport smelter is still down.

The recent reports from Washington have brightened the hopes for a protective tariff on magnesite. If this tariff materializes this important Washington industry will be revived.

Several of the larger coal mines of western Washington are operating on an open-shop basis, but at present are making only a fraction of their regular output.

IDAHO

Nabob Consolidated to Resume

Wallace—The western and eastern interests in the Nabob Consolidated Mining Co. have effected a settlement under the terms of which the Stewart Mining Co. renounces all claims against the company for about $40,000, which it had advanced. Plans for refinancing the Nabob have been completed. Mining operations will be resumed July 1.

Byron Wilson, of Wallace, a mining engineer long connected with the Federal Mining & Smelting Co. and other companies controlled by the Guggenheim interests, has gone to Alaska to take charge of the property of the Rae-Wallace Mining Co. in the Willow Creek district. The company owns a large group of gold claims which have been extensively developed.

CALIFORNIA

Belmont Shawmut in Full Operation—Blue Hog Mine Returned to Feather River Company

San Francisco Correspondence

San Francisco—The Belmont-Shawmut, at Shawmut, is dropping eighty stamps and is in full operation. The Santa Ysabel and the Longfellow are being reopened, and reports indicate that the Black Oak, near Soulsbyville, and the Tarantula and Gold Ridge properties may resume operations in the near future.

Equipment has been installed, the main shaft has been deepened, and development is in progress on the Chilena group, on Jackson Hill, near Tuttletown.

Preparations to work the Malikoff drift mine at North Bloomfield are well under way. A sump has been sunk below the bedrock and bins of 150 tons capacity have been constructed. A gasoline hoist is ready for operation.

By a recent court decision the Blue Hog mine between Paradise and Magalia has been returned to the Feather River Land & Mining Co. by the Paragalia Mining Co.

NEVADA

Tonopah Shipments Above Normal—Suit at Hornsilver Settled

From Our Special Correspondent.

Virginia City.—At a meeting of the miners held in Virginia City, May 31 the strike against the United Comstock was unanimously declared off.

It is reported that the east crosscut being run in Savage ground by the Paramount Comstock Mines Co., owner of the Middle Mines group, entered ore at 100 ft. and has been in ore of about $90 grade for the last 20 ft. The option on the Middle Mines group, held by the Middle Comstock Mines Syndicate, expired on June 1.

Tonopah—Regular ore shipments are being made by the North Star to the Belmont mill, and mine conditions are good. Through use of the Belmont mine maps and geological charts, additional ore is being developed near the Belmont lines, and it is thought that a faulted segment of the rich so-called "Heney" stope has been found.

Bullion shipments made on June 5, representing clean-up of operations for the last sixteen days in May, were as follows: Tonopah Belmont, $140,300; West End, $104,900; Tonopah Extension, $73,000. The Tonopah Mining cleanup has not as yet been reported, but will probably be as usual, or about $60,000. Practically all shipments are at least 10 per cent above normal and indicate the prosperous condition of the mines in the Tonopah district.

Golden Arrow—The recent developments on the Storm Cloud group, five miles south of Golden Arrow, at present optioned to Tonopah and Reno mining men, have created considerable interest in the district. High-grade silver ore has been uncovered in shallow workings, and preparations are being made to sink to greater depths.

Hornsilver—The suit between the Southwestern and Silvermines Co. and the men who jumped the sixteen claims last July on the assumption that the regular assessment work had not been performed has been settled. A 1,500,000 share corporation will be organized to take over the sixteen claims, and the locators will receive 100,000 shares of stock in the company and $1,000 in cash, they agreeing to relinquish all right and title to the ground.

COLORADO

Ouray Leasing Co. to Start Mill—Road Building to Silverton

Ouray—The Welch-Worland Mines Syndicate has shut down the mill at the Wanakah and announced that it will concentrate on a certain development drift for the next month. If this does not yield new ore, the company will probably abandon the property, permitting it to revert to the Ouray Union Mining & Milling Co.

Rydin and Sederholm are driving a development or exploratory adit low down on the old Great Western, to look for downward continuation of the old oreshoot.

The Ouray Leasing Co. has quit drifting on the lower adit of the Barstow and is opening a stope in the ore discovered by the drift last winter. The mill will be started about July 10.

NEW MEXICO

Conditions Improving—Silver City District More Active—Coal Plentiful

Silver City—Mining conditions generally in New Mexico are improving. Production in the state's major district, surrounding Silver City, will not reach normal for some time, but there is encouragement in the statement that Chino will be producing at 50 per cent of normal soon. Necessity for doing assessment work before July has temporarily caused greater activity. Small shipments of silver by many individual operators have materially increased the silver output. Manganese shipments are totaling 600 to 1,000 tons a day from Grant County.

Labor presents no serious difficulties now. Mine forces are being increased gradually, and advance notices sent out some time ago warned against an influx of workers, as the companies planned to hire their "old" men first. All local labor has been absorbed in manganese operations at Silver City and Fierro.

The coal strike has affected mining only as an incident. The New Mexico coal mines produce plenty of coal, and the camps are not organized, although an attempt at organization was made recently, and resulted in small trouble. Recent reductions on freight rates to the El Paso smelters were announced, and were helpful, but no noticeable effect has been reported as a result of the announcement of a forthcoming general reduction. Such a general reduction, however, will increase tonnage somewhat in the future.

ARIZONA

Gallup Coal Supply Ample—Skilled Miners Scarce at Bisbee—Ray Consolidated Wins Suit

The coal strike appears to have not seriously affected the patrons of the Gallup, N. M., field. At no time has there been failure to deliver orders for domestic, steam, railroad, or smelter fuel, and the price of the product has been dropping. The miners struck in sympathy with their Eastern co-workers, but their places were filled by surface hands or new men. For a while protection was afforded by the New Mexico National Guard, but that was withdrawn early in June. Freight rates, too, have fallen. Coal is being delivered at Clarkdale for about $3 per ton freight, a drop of 50c., with a possibility of a further 10 per cent reduction, ordered by the Arizona Corporation Commission. The late freight reduction of 12½ per cent is effective until Oct. 15. Much of the Gallup coal is marketed in Southern California, in competition with Oregon, Washington, and British Columbia shoals.

The Arizona & Swansea railroad again is in operation, from Bouse to Swansea, Ariz., carrying ore and concentrates for the Swansea Lease, billed to Humboldt. The railroad, mainly owned by the Mitchell interests, of Los Angeles, is operated under order of the Arizona Corporation Commission, which repeatedly has refused permission for its abandonment. The road is twenty-three miles long.

Skilled miners and mechanics are wanted by the Copper Queen and other mines of the Bisbee section. Possibly 300 more miners could find employment, though few laborers are needed. The same condition is said to exist in the Globe and Jerome districts.

The Copper Queen smelter is to produce 10,000,000 lb. in June. There is a report that concentrates soon will be coming from Morence.

Ray—The Ray Consolidated Copper Co. has won its suit against the Ray-Broken Hills Mining Co., P. A. Schilling, and Joseph Sherlock, a jury finding for the plaintiff in all twelve questions submitted. The question of the ownership of the water supply of Indiana Springs was involved.

UTAH

Park Standard Mining Co. Incorporated—Alta-Wasatch Railroad Seeks Permission to Shut Down

From Our Special Correspondent.

Eureka—Shipments for the week ended June 2 amounted to 168 cars. Shippers were: Chief Consolidated, 56 cars; Tintic Standard, 36; Iron Blossom, 18; Eagle & Blue Bell, 11; Victoria, 10; Grand Central, 10; Colorado, 10; Centennial-Eureka, 4; Swansea, 3; Mammoth, 2; Empire Mines, 2; Sioux Consolidated, 2; Sunbeam, 2; Bullion Beck, 1, and Tintic Drain Tunnel, 1.

Park City—Shipments for the week ended June 2 amounted to 3,437 tons. Shippers were: Ontario, 1,435 tons; Park-Utah, 819 tons; Silver King Coali-

tion, 763; Judge, Daly and Daly West, 488 tons.

The eastern section of the camp, practically undeveloped for many years, is now receiving more attention since the Park-Utah in this section became one of the large producers of the state. Also the finding of ore in the Ontario mine east of the north-south fault dividing the property has stimulated activity. Recently, a new company, the Park Standard Mining Co., has been incorporated to exploit ground in the eastern section adjoining the Valleo. This company owns ten claims and has 120 acres under lease besides. The incorporators are: N. A. Dunyon, M. J. Dailey and John D. Foster, of Park City; and R. P. Morris and Judge William H. Bramel, of Salt Lake City. The company is capitalized at $150,000.

Alta—The Little Cottonwood Transportation Co., which owns a narrow-gage road running from Alta to Wasatch, has applied to the State Public Utilities Commission for permission to remain inactive during the present shipping season. The reason given is that a number of Alta mines have made arrangements to have their ores taken to Wasatch by teams. The latter are available throughout the year, whenever the roads are sufficiently open, whereas the railroad, owing to climatic conditions, is necessarily inactive for about half of the year. For this reason transportation by team appears more practicable. From Wasatch the ores are taken over to Denver & Rio Grande to the smelter at Murray.

Work is being done at the West Toledo, which lies in Little Cottonwood Canyon between the Cardiff and the Columbus-Rexall. Directors recently elected are J. C. Dick, A. J. Hurley, Arthur Thomas, James A. Foley, and Thomas L. Mitchell.

Salt Lake City—Roads in Big Cottonwood Canyon are opening up. The Alta Tunnel & Transportation Co. has broken its way through to its upper ore piles, and has made its twenty-third shipment.

WISCONSIN-ILLINOIS

Rate of Production Increased in Zinc-Lead District—Labor Still Plentiful

Platteville—The rate of production of finished zinc ore concentrates for May has slightly increased over production for any other month this year. The production for May will be approximately 3,200 tons of 60 per cent zinc ore concentrates. The surplus of zinc concentrates available for sale has been reduced to about 3,000 tons. Lead ore concentrates are being sold as rapidly as produced, and no surplus exists in the district. Future production of the district will be highly dependent upon an increased market, as few mines can produce ore at a profit on the now prevailing market of $31 per ton. Should the market advance from $5 to $10 per ton in the next few months, no doubt production would be stimulated 50 per cent, the rate of production now being about 35 per cent of normal.

A concentrated effort of mining companies in the district is being brought to bear to reduce freight rates on ores to Eastern smelters. A joint conference of railroad officials and representatives of the mining industry was held in Chicago May 22 with this purpose in view.

Labor in the district at present is plentiful, considering the small production. Should production be materially increased, there would be a shortage of miners.

Prospecting for new orebodies will be started by the Vinegar Hill Zinc Co. in the near future after a lapse of nearly two years from this line of development.

JOPLIN-MIAMI DISTRICT

Extensive Drilling Started by American Zinc, Lead & Smelting Co.—Butte-Kansas and Acme to Resume

BY P. R. COLDREN

Joplin—The American Zinc, Lead & Smelting Co. has taken a drilling option on 320 acres immediately adjoining its High Five mine, in Missouri, in the Waco camp, and has started eight drills in operation in a development campaign. The company, according to a rumor, is planning extensive drilling from this location toward the east, possibly as far as the old Neck City camp in the Missouri field, northeast of Carterville, but officials of the company deny that any such plans have been completed.

The company's High Five mine is operating steadily and with good results. It is in Missouri, but the west side of the lease is bounded by the Kansas-Missouri state line. The Barnsdall Zinc Corporation, which is the big operator in the Waco camp, has one mine on the Missouri side and two mines in Kansas.

Announcement has just been made by officials of the Butte-Kansas Mining Co. that the Butte-Kansas and the Acme mines will resume at once, following a shut-down since October, 1920. Since being down the company has carried on an extensive drilling campaign on the north part of its lease, and has put down about 150 holes.

SOUTHEAST MISSOURI

Improved Price of Lead Causes Greater Activity

Activity in the southeast Missouri lead belt is slowly increasing in view of the excellent pig lead market of 5½c. The coal strike thus far has not affected operations there, as the four large companies laid in a supply for sixty days or more, before the strike started on April 1, and should their supplies become exhausted before the Illinois mines reopen, which it now seems, may be delayed until Sept. 1, they will be able to get western Kentucky coal for $5 per ton, which will not be more than 30 or 40 per cent advance over recent Illinois prices.

The proposed horizontal reduction of 10 per cent in freight rates will not have an important bearing, it is said, as pig lead is generally sold in the St. Louis market, and producers already have special rates to the Illinois coal fields. The expected advance in Illinois coal prices after the strike is over will have a much greater influence.

The Annapolis Lead Co. is now erecting a 1,000-ton mill and recent drilling has considerably enlarged its orebody. It has also taken an option on the Schulte lands, near Fredericktown, where a shaft was started by the late H. J. Cantwell.

ALABAMA

North American Steel Merger of Importance to Birmingham District—Operators Activity Increasing

BY GEORGE HUNTINGTON CLARK

Birmingham—Of most importance to Alabama at the beginning of June is the reported merger of the Midvale, Republic, and Inland steel corporations into the newly organized North American Steel Corporation. Through this merger, Birmingham is to become the southern end of a great steel interest, the Republic Iron & Steel Co. owning three large and modern blast furnaces situated at Thomas, ample coke oven plants, and coal and iron mines, together with extensive dolomite quarries at various points in the district, practically all of which properties are now in active operation.

Whether these properties are to be made the nucleus around which to build up a southern steel business is as yet, of course, purely conjectural, but many conditions surrounding these Republic properties strongly indicate such a purpose. On the basis of present operation, the companies in the merger are said to have a combined ingot production of 5,000,000 tons per year.

Notwithstanding May increases in iron making, yard stocks of iron held decreased in May 20,000 tons, being estimated June 1 at 60,000 tons, against 235,000 tons of accumulated stocks on hand, June 1, 1921.

The Sloss Sheffield Steel & Iron Co., by blowing in another North Birmingham stack, has advanced its production from five active furnaces to a monthly iron output of approximately 50,000 tons. Coal production has increased from 275,000 to 325,000 tons per week.

The Federal Coal Terminal recently completed at Mobile, with a loading capacity of 40,000 tons for bunker and export coal, has now been placed in operation as an assisting factor.

Operations of the Tennessee Coal, Iron & R.R. Co. are continuing at capacity.

With labor advances recently and voluntarily made, both by the Tennessee company and by the Woodward Iron Co. to all classes of mine men and furnace men, unemployment is stated to be virtually now at an end, and skilled labor in demand.

THE MARKET REPORT

Daily Prices of Metals

June	Copper, N. Y., net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
8	13.625@13.75	31.125	32.00	5 75@5.80	5.50@5.65	5.40@5.425
9	13.625	31.00	31.875	5.75@5.80	5.625	5.40@5.425
10	13.625	31.00	31.875	5.75	5.625	5.40@5.425
12	13.50@13.625	30.50	31.50	5.75	5.625	5.425
13	13.50@13.625	30.25	31.00	5.75	5.625	5.425
14	13.50@13.625	30.375	31.125	5.75	5.625	5.425

*These prices correspond to the following quotations for copper delivered: June 8th, 13.875@14; 9th and 10th, 13.875; 12th to 14th, inc., 13.75@13.875c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

June	Copper Standard Spot	Copper Standard 3M	Copper Electrolytic	Tin Spot	Tin 3M	Lead Spot	Lead 3M	Zinc Spot	Zinc 3M
8	62⅜	62¾	69½	153⅜	154½	24⅞	23⅞	28⅛	27⅛
9	62	62⅜	69½	153	154¼	24⅞	23⅞	28⅛	27⅛
10	...	...	...	...	...	...	...	...	...
12	61⅜	61⅝	69½	151¼	153¼	24¾	23⅝	28⅛	27⅛
13	61	61⅜	69	150½	151½	24½	23½	28	27⅝
14	61⅜	61⅝	69	150⅜	151¾	24½	23½	27¾	27⅝

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

June	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	June	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
8	449¾	99⅛	72¼	35⅞	12	448¾	99¼	71½	35⅜
9	449	99⅜	71⅞	35¾	13	448	99⅛	72¼	35⅞
10	449½	99⅜	71⅞	35¾	14	447	99⅛	72⅛	36⅛

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths of a cent premium.

Metal Markets

New York, June 14, 1922

Buying has not been so active during the last week, and prices in general have shown a somewhat easier tendency as a result, though zinc continues firm. The violent decline in security prices on the New York Stock Exchange on Monday without doubt had a depressing effect on the metal market. The reaction was to be expected, however, after the long upward swing; it is not likely to assume large proportions, for metal is going into consumption at a satisfactory rate and general business conditions continue to show improvement. The coal strike continues, and stocks are being depleted. Non-union production cannot keep pace with consumption. However, until an actual pinch is more in evidence there seems little likelihood of a settlement.

Copper

The amount of copper sold in the last ten days has been exceedingly small, and although the larger producers are holding their prices steady at from 13⅞ to 14c. delivered, the presence of speculative lots and offerings by trading interests has had the effect of depressing the price at which the metal could be obtained. The sales at the higher prices were confined chiefly to carload business, but there was little demand for larger lots. Quick to sense a probable weakness in the market, on Monday and Tuesday two large electrical companies put out inquiries for large tonnages with deliveries running into the future months, and received very attractive offers at prices substantially below those which had been ruling up to that time.

Export demand did not fall away to the extent that domestic did, but the prices realized did not average quite so high as last week. In the last two or three days, second-hands have offered copper at 13.5c., f.a.s.

Lead

The official contract price of the American Smelting & Refining Co. continues at 5.75c., New York.

Demand in the East has not been quite so active during the last week, and the premiums asked by outside interests have become largely nominal. Lead has been freely available the last few days at 5.75c., New York, from more than one producer, and deliveries at this price could be arranged for as late as September. One producer who has been inactive for some time was a ready seller. Spot delivery has been held at a 5- to 10-point premium, but sales have been comparatively small.

In the St. Louis district, practically all of the business has been done by one important producer, who has been selling freely at 5.625c. Efforts by others on Thursday and Friday to secure 5.65c. were not favorably received; in fact, some sales were made on those days even below 5.60c.

The market appears to be likely to stand at present levels for a time, and the unloading of surplus stocks and the diversion of supplies ordinarily going to Europe has had the stabilizing effect desired.

Zinc

The most important news of the week is the statistics released by the American Zinc Institute, which are as follows: Stock on hand, May 1, 51,728 tons; produced during May, 27,419; shipped during May, 38,738; leaving stock on hand May 31, 40,409. Shipped during May for export, 3,518. Stored for account of customers (not included in stock on hand), 1,808. Total retort capacity, 152,008; number of retorts available, 133,456; average number of retorts operating during May, 47,885; number operating at end of month, 48,765. The decrease in stocks is looked upon as exceedingly favorable to higher prices, and if consumption continues to outstrip production the price will soon reach such a figure that some of the Northwestern producers now shut down will find a resumption profitable. Demand during the week has been good

from both galvanizing and brass interests, and the price is slightly above the figures of the week before. High-grade is quoted at 6.25c. with a 30-point freight allowance. The New York prices are 35 points above the St. Louis quotations.

Tin

Prices have declined, owing to weakness in London prices and a fall in sterling exchange. Spot tin has been in free supply during the last two or three days, and is now obtainable at the same prices as are asked for forward deliveries. Thursday and Friday a ¼c. premium was asked. The stocks held in the Malay States seem to be in a condition of active liquidation, and it is reported that 2,500 tons left those shores during the first week in June. This has had a somewhat depressing effect. Banca tin, which is of higher grade than Straits, though not so well known, has gone begging, and sold yesterday for ⅛c. less than was obtained for Straits. Chinese tin is still offered.

Arrivals of tin, in long tons: June 12th, Liverpool, 25; 13th, Liverpool, 20.

Gold

Gold in London: June 8th, 91s. 6d.; 9th, 91s. 9d.; 12th, 91s. 9d.; 13th, 92s. 1d.; 14th, 92s. 6d.

Foreign Exchange

Sterling reacted during the week and other foreign exchanges shared in the decline. On Tuesday, June 13, francs were 8.77c.; lire, 4.97c.; marks, 0.31625c.; and Canadian dollars, 99.125c.

Silver

The market continues uncertain, with only moderate business, although the demand in the early part of the week for prompt New York delivery brought the local price well above the parity of the London quotation. The market closes quiet.

Correction—The price of silver in London on June 7 was quoted last week as 35⅝d. This should have been 35⅝d.

Mexican Dollars—June 8th, 55¼; 9th, 55; 10th, 55; 12th, 54⅝; 13th, 55¼; 14th, 55¼.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum — 20c. per lb. for 99 per cent grade; 19c. for 98@99 per cent; 18c. for 94@98 per cent. Outside market nominal at 17.25@18.25c. for 98@99 per cent virgin grades.

Antimony — Chinese and Japanese brands, 5.25@5.30c. W.C.C., 6@6¼c. Cookson's "C" grade, spot, 8.75c. Chinese needle antimony, lump, nominal, 3.5@4c. per lb. Standard powdered needle antimony (200 mesh) nominal at 5¼c. per lb. White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, 6.75@7c.

Bismuth—$2@$2.10 per lb.

Cadmium—$1.20@$1.25 per lb.

Iridium—Nominal, $150@$170 per oz.

Nickel—Standard market, ingot and shot, 36c.; electrolytic, 39c. Outside market quiet at 29@32c. per lb.

Palladium—$55@$57.50 per oz.

Platinum—$87.50 per oz.

Quicksilver—$55@$56 per 75-lb. flask. San Francisco wires $55. Strong.

The prices of **Cobalt, Magnesium, Molybdenum, Monel Metal, Osmium, Rhodium, Selenium, Thallium** and **Tungsten** are unchanged from the prices in the issue of June 3.

Metallic Ores

Lake Superior Iron Ore—Prices for the 1922 season were developed last Friday at a 50c. decline from the 1921 schedule, making Mesabi non-bessemer $5.05, f.o.b. Lake Erie docks. The Lake vessel rate is down 10c. and shippers expect 25c. reduction in upper Lake rail freight rates, thus having 15c. of the decline to absorb themselves.

Chrome, Magnetite, Manganese, Molybdenum, Tantalum, Titanium, Tungsten, Uranium, Vanadium, and Zircon ore are unchanged from the quotations published June 3.

Zinc and Lead Ore Markets

Joplin, Mo., June 10—Zinc blende, per ton, high, $33.55; basis 60 per cent zinc, premium, $33.50; Prime Western $32.50; fines and slimes, $31@$29; average settling price, all grades of blende, $31.27; calamine, basis 40 per cent zinc, $15.

Lead, high, $73.95; basis 80 per cent lead, $75@$78; average settling price, all grades of lead, $72.96 per ton.

Shipments for the week: Blende, 11,044; calamine, 33; lead, 1,344 tons. Value, all ores the week, $443,360.

Scarcity of purchasable ore has developed sharp competition among buyers to secure a supply in anticipation of a possible railway strike. Smelters have already purchased a considerable tonnage and are making unusual effort to move material to the works as speedily as possible.

Limited production of lead in the West keeps the demand centered on the supply of this district.

Platteville, Wis., June 10—Blende, basis 60 per cent zinc, $33 per ton. Lead ore, basis 80 per cent lead, $77.50 per ton. Shipments for the week: Blende 241 tons; lead ore, none. Shipments for the year: Blende, 6,945 tons; lead ore, 977 tons. Shipped during the week to separating plants, 1,117 tons blende.

Non-Metallic Minerals

Feldspar—Canadian feldspar, 13 per cent K_2O and 65 per cent SiO_2, continues at $10 per net ton, f.o.b. Quebec quarry. Market improving.

Graphite—Ceylon lump, first quality, 7@10c. per lb., f.o.b. N. Y.; chip, 5@6.5c. per lb.; dust, 4@5c. per lb.; amorphous crude, $18@$70 per ton; flake, 6@9c. per lb. The market is somewhat improved, although most consumers still have large stocks on hand. Present purchasing is only for certain grades on which demand could not be anticipated. Expected import duties no doubt are contributing to increased buying before they become effective.

Talc—High-grade foundry talc, $20 per ton, or $18 in carload lots, f. o. b. Virginia mills. Demand better.

Asbestos, Barytes, Bauxite, Borax, Chalk, China Clay, Emery, Feldspar, Fluorspar, Fuller's Earth, Gypsum, Limestone, Magnesite, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica, Sulphur, and **Talc** are unchanged from the prices published June 3.

Mineral Products

Arsenious Oxide—7@7.25c. per lb.

Copper Sulphate — 6.25c. for large crystals. Prompt shipment scarce.

Sodium Nitrate—$2.50 per 100 lb. ex vessel, Atlantic ports.

Potassium Sulphate and **Sodium Sulphate** are unchanged from quotations of June 3.

Ferro-Alloys

Ferrosilicon—10 to 15 per cent, $38 @$40 per gross ton, f.o.b. works; 50 per cent, $58@$60; 75 per cent, $115@$120.

Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrotitanium, Ferrotungsten, Ferro-uranium, and **Ferrovanadium** are unchanged from the prices published June 3.

Metal Products

Copper Sheets—New York base, 20.50c. per lb.; wire, 15.75c.

Nickel Silver—26.75c. per lb, for 18 per cent nickel Grade "A" sheets.

Yellow Metal—Dimension sheets, 17.75c.; rods, 14.75c. per lb.

Lead Sheets and **Zinc Sheets** are unchanged from the quotations published in the June 3 issue.

Refractories

Bauxite Brick, Chrome Brick, Chrome Cement, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick, and **Zirkite** are unchanged from the prices appearing in the issue of June 3.

The Iron Trade

Pittsburgh, June 13, 1922

The steel market position continues a strong one throughout, but with a lessened turnover, mills being comfortably sold up and buyers somewhat more cautious. Bars, shapes, and plates range from 1.60c. to 1.80c., depending on tonnage, time of delivery and other conditions, and hoops and sheets also show a price range.

The Steel Corporation's unfilled obligations increased by 157,311 tons in May, against an increase of 602,769 tons in April.

Pig Iron.—The market continues stagnant, quotable prices, now partly nominal, remaining at $25, Valley, for bessemer and basic and $24 for foundry.

Coke

Connellsville Coke—Demand and offerings are limited, prices remaining at about $7 for furnace and $7.50 for foundry.

COMPANY REPORTS

Nevada Consolidated Copper Co.

The combined statement of the Nevada Consolidated Copper Co. and the Nevada Northern Railway Co. for the year 1921 is as follows:

ASSETS

	Dec. 31, 1921	Dec. 31, 1920
Property, equipment and construction	$21,389,593.62	$21,087,195.03
Less ore extinguishment and depreciation	12,858,047.98	11,915,323.21
	$8,531,545.64	$9,171,871.82
Investments in securities and rights	58,599.23	58,599.23
Deferred charges to mining operations	5,620,701.49	5,655,536.03
Copper Export Association, Inc., suspense	524,794.34	.....
Materials and supplies on hand	1,540,028.11	2,124,540.33
Accounts and notes collectible	656,854.83	446,297.49
Deferred accounts	179,816.18	96,708.37
Metals on hand and in transit	2,644,688.50	7,017,301.57
Marketable securities	235,534.00	235,534.00
Cash	3,419,452.02	867,353.84
	$23,412,014.34	$25,673,742.68

LIABILITIES

Capital stock outstanding (Nev. Con. Cop. Co. only)	$9,997,285.00	$9,997,285.00
Surplus (from capital stock and securities sold in excess of par value or cost)	7,071,850.17	7,071,850.17
Accounts payable (not due)	456,650.46	814,567.95
Unpaid treatment on metals (not due)	343,172.48	548,240.43
Deferred accounts	73,744.05	66,537.73
Surplus from operations	5,469,312.18	7,175,261.40
	$23,412,014.34	$25,673,742.68

The statement of operations for the year ended Dec. 31, 1921, is as follows:

Operating revenue		
Copper produced—9,362,325 lb. @ 12.535c. f.o.b. refinery	$1,173,595.62	
Gold and silver produced	106,550.95	
		$1,280,146.57
Operating expenses		
Mining, including proportion of stripping expense	$375,291.82	
Ore delivery—mine to mill	80,786.34	
Milling	374,698.48	
Smelting	264,323.47	
Freight and refining	167,328.67	
Selling commission	1,315.28	1,263,744.06
Net profit from operations		$16,402.51
Miscellaneous income		34,121.46
Total income		$50,523.97
Charges against income		
Depreciation	$857,341.08	
Shutdown expense	714,440.05	
Loss on copper sold during shutdown period	111,907.24	1,683,688.37
Net loss to surplus account		$1,633,164.40

SURPLUS FROM OPERATIONS

Balance Dec. 31, 1920	$6,538,602.24
Loss for year (exclusive of depletion)	1,633,164.40
Balance, Dec. 31, 1921	$4,905,437.84

Operations were suspended on March 31, 1921, at the company's properties at Ruth and McGill in Nevada. The ore mined amounted to 450,590 tons, assaying 1.62 per cent copper. Dry tons milled was 392,645, averaging 1.49 per cent copper.

Production of refined copper during the 1921 operating period was 9,362,325 lb. as compared with 48,311,985 lb. for 1920. Excluding depreciation of plant and equipment, but including all taxes and overhead, the total operating cost per pound of copper produced was 13.50c. Applying the usual credits for gold and silver and miscellaneous earnings, amounting to 1.16c., the net copper cost for 1921 was 12.34c. as compared with 15.67c. per lb. on similarly calculated costs for the year 1920.

Oriental Consolidated Mining Co.

The balance sheet of the Oriental Consolidated Mining Co., with head office at 15 Broad St., New York, and mines and works in the Unsan district of Korea, was as follows, as of Dec. 31, 1921:

CAPITAL AND LIABILITIES

Capital stock (authorized)		$5,000,000	
Less unissued stock		706,100	
			$4,293,900
Sundry creditors			35,689
Surplus profits on hand June 30, 1920		520,693	
Less:			
Dividend No. 40 paid July, 1920	$214,695		
Dividend No. 41 paid August, 1921	214,695		
United States income tax paid	33,120		
Loss for eighteen months, June 30, 1920 to Dec. 31, 1921	234,064		
		696,574	
Deficit Surplus, Dec. 31, 1921		$175,881	
Reserves for			
Depreciation	$1,825,000		
Depletion	683,626		
		2,508,626	
Net Surplus and Reserves			$2,332,745
			$6,662,335

PROPERTY AND ASSETS

Mines and property	$4,293,900
New construction and development	1,029,769
Additions as of March 1, 1913—plant and equipment	750,000
Cash	257,259
Sundry debtors	49,254
Supplies	261,429
Tax 1922 paid in advance	12,500
Insurance paid in advance	8,222
	$6,662,335

Profit-and-loss-account for the eighteen months ending Dec. 31, 1921, is as follows:

DEBIT

	Cost Per Ton	
Mining costs, 327,193 tons of ore mined and milled	$2.98	$975,292
Miling costs	.66	214,489
Concentrates expenses	.25	80,971
Transportation of ore	.02	5,472
General expenses	.49	159,069
Total operating and general expenses	$4.40	$1,435,295
Depreciation	1.14	375,000
Depletion, 5 per cent of output	.25	81,345
Total debits	$5.79	$1,891,640
Loss for eighteen months to balance sheet	.72	234,064
	$5.07	$1,657,576

CREDIT

Bullion from mills	$2.41	$788,770
Concentrates	2.56	838,135
Interest and other receipts	.10	30,669
	$5.07	$1,657,576

The total receipts for the eighteen months were $5.07 per ton; the costs, $4.40 per ton; and the depreciation and depletion reserves, $1.39 per ton; leaving a net loss of 72c. per ton. The efficiency of native labor was reported to be lower than ever before, and the adverse exchange tended to keep away Chinese labor. Timber was unusually expensive. The combined ore averaged $6.05 per ton. The report is particularly complete and gives detailed costs of all operations.

The company reports that operating costs continue to be high. Two 5 per cent dividends, aggregating $429,390, were paid during the eighteen-month period between July 1, 1920, and Dec. 31, 1921, the report explaining, however, that most of the money for these was obtained from accumulated surplus and not from profits earned during the period.

Fire broke out in Tabowie mine on Nov. 10, 1920, causing heavy damage. Six months' efforts were required to put out the fire. Tonnage mined and milled was consequently much reduced.

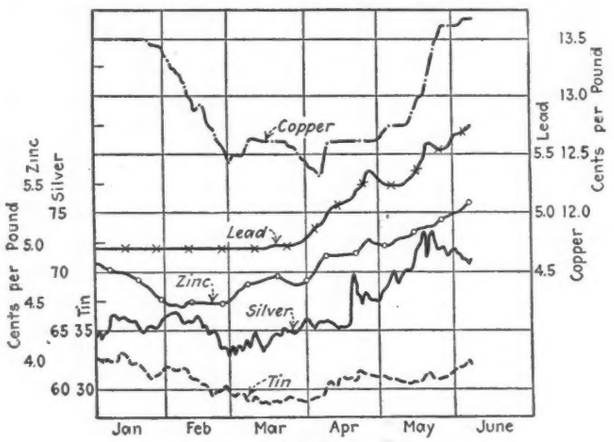
The Advance in Metal Prices

Among the Metals of Chief Interest to American Producers, Copper, Zinc, and Lead Have Shown Increasing Strength During the Spring

By Edward H. Robie

THOSE LIVING in metal-mining districts and investors in shares of metal-mining companies may well feel encouraged over the price tendencies of the more important non-ferrous metals in the last three months, as illustrated in the accompanying chart.

The long buying movement in copper which took place in the fall and early winter of 1921 left the refinery price at 13.5c. at the beginning of this year. The January demand was poor, however—only about 75,000,000 lb.—and immediately the price slumped, owing to the desire of certain producers to sell a pre-determined amount, or their current output, in the domestic market. Though sales for February showed an improvement, amounting to slightly over 100,000,000 lb., the demand came too late to affect the price before the end of the month.



Variations in Metal Prices Since Jan. 1

Despite the large sales of March, reported at 184,000,000 lb., the price did not materially advance, and the announcement of a resumption of production by the porphyries had a most depressing effect, causing the price to fall to what will in all probability be the low of the year—12.25@12.375c., refinery. Then it began to be realized that the resumption was justified by the fact that most of the companies were practically sold out of stocks of copper available for domestic deliveries, and that average demand would necessitate an increased supply. Some fear was felt that the large producers, which depend for efficient operation on large tonnages, would attempt to run to capacity, make copper as cheaply as possible, and force some of the higher-cost producers to close down. So far no tendency to do this has been noted; the porphyries have announced a resumption at only 50 per cent of capacity, which will hardly prove a burden on the market unless the summer demand is much below expectations.

The Copper & Brass Research Association no longer issues statistics of consumption even to its members, so that no official figures are now available for total monthly sales of copper. However, it is likely that the sales in May were above those of any other month in 1921 or 1922. Most of these were for June and July delivery, with some sold as far ahead as August. At present, consumers' demands for the summer have been pretty well booked, and it would not be surprising to see somewhat of a lull in demand during the next month or two. However, the experience of recent weeks has indicated little pressure to sell by cutting prices, and even with a slump in demand, the price should at least remain substantially constant. Should demand improve—and there is reason to believe that it will—15c. copper may be reached before the end of the summer.

It is of interest to note that the increased price of copper is meeting with extreme disfavor in the London metal market. Hardly an issue of *The Metal Bulletin* is received that does not contain such comments as these: "It is difficult to feel confidence in the position in the face of the steady increase which is going on in production." "Whilst the upward movement might be carried a little further, there does not seem any ground to anticipate a great rise." "Owing to the big quantity of copper earmarked for export . . . it seems inevitable that the price asked for them [the exportable stocks] will ease off." "If the large interests in America would only be content to feed the market as it showed appetite, they would undoubtedly do more business. The effect of the present policy [of increasing prices] is to keep consumption from expanding as it might do, and to encourage production." "The trouble with the big American copper people is that they can never let well alone, but as soon as demand begins to rear its head, they raise their price out of reach."

Lead has shown more strength than the closest followers of the industry had expected. All during the winter the price held constant, with production and consumption practically balanced, with Mexican production going abroad, and with the comparatively small stocks of lead, held in this country, produced at a high cost, in strong hands. In the middle of March, however, the demand began to pick up, and soon was a little greater than those selling at fixed prices were able to supply. Paint manufacturers had been taking large amounts of lead for some time, but with the coming of spring, lead for automobile batteries was in much greater demand, building materials absorbed considerably increased amounts, cartridge makers were preparing for an active season, and the lead-covered cable business improved. Prices therefore began to be advanced, with the leading domestic lead producer holding its official price somewhat behind the outside market. One or two slight recessions have occurred, as indicated on the chart, but the price seems headed for 6c.

In an effort to prevent a runaway market, several thousand tons of lead which has been held in storage for a year or two in the hope of improved prices has been released, and Mexican lead has been sold in this country, as is indicated by a preponderance of imports over exports. But the market seems to have a hearty appetite. Lead production in foreign countries, principally Spain and Australia, has been greatly curtailed owing to labor troubles; these have now been settled, in some measure, and with the higher prices foreign lead production is likely to increase rapidly during the rest of the year. By the end of summer, consumption is likely to fall away somewhat, for some of it is seasonal. Then, too, the increase in the price of zinc will stimulate lead-zinc producers; and the increase in foreign silver will stimulate foreign silver-lead producers. So, with the price now 35 per cent above the 1912-1914 average, markedly higher prices are hardly to be expected, though the next two or three months may record a continued advance.

Zinc has had the smoothest rise of all of the metals, and the most long continued, beginning in a small way early in February, when what will doubtless be the low for the year was reached. Both the galvanizing and brass trade has improved materially since early spring, taking increased amounts of zinc. The brass trade has taken increased tonnages of zinc, too, because of the exhaustion of war stocks of scrap brass, which are no longer much of a factor. Stocks of zinc at the beginning of the month, together with production and consumption during the month, are indicated in the following table, for which appreciation should be extended to the American Zinc Institute:

Month	Stocks	Production in Tons	Consumption in Tons
January	66,608	23,706	24,636
February	65,678	22,513	24,067
March	64,124	26,532	30,394
April	60,262	25,506	34,040
May	51,728	27,419	38,738
June	40,409	.....	.....

The healthy condition of the zinc industry is at once apparent, and the price should gradually work its way above that of lead, as it was before the World War. With or without a tariff, there seems little to fear from foreign zinc; in fact, during the last two or three months several thousands of tons of zinc have been sold abroad, including that to countries ordinarily thought of as important producers.

MINING STOCKS

Week Ended June 10, 1922

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	65	62½	62½	Sept. '20, Q	$0.50
Alaska-Br. Col. new.	N. Y. Curb	5¼	4½	4½	.....	....
Allouez	Boston	28½	27½	27½	Mar. '19	1.00
Anaconda	New York	56¼	52¾	53	Nov. '20, Q	1.00
Arcadian Consol.	Boston	4¼	4	4	.....	....
Ariz. Com'l	Boston	10½	10	10	Oct. '18, Q	0.50
Big Ledge	N. Y. Curb	*20	*17	*17	.....	....
Bingham Mines	Boston	16¼	15½	15½	Sept. '19, Q	0.25
Calumet & Arizona	Boston	....	....	65½	Mar. '22, Q	0.50
Calumet & Hecla	Boston	290	280	280	June '20, Q	5.00
Canada Copper	N. Y. Curb	*38	*35	*35	.....	....
Centennial	Boston	12	10½	10½	Dec. '18, SA	1.00
Cerro de Pasco	New York	39¼	36¼	37	Mar. '21, Q	0.50
Chile Copper	New York	23	21	21	.....	....
Chino	New York	32⅜	30½	30½	Sept. '20, Q	0.37½
Columbus Rexall	Salt Lake	*29	*28	*28½	.....	....
Con. Arizona	N. Y. Curb	*5	*5	*5	Dec. '18, Q	0.05
Con. Copper Mines	N. Y. Curb	1 1/16	1	1 1/16	.....	....
Copper Range	Boston	46½	44¾	44¾	Mar. '22, Q	1.00
Crystal Copper	Boston Curb	1⅛	1⅛	1 1/16	.....	....
Davis-Daly	Boston	8⅛	8¼	8¼	Mar. '20, Q	0.25
East Butte	Boston	11⅜	11	11	Dec. '19, A	0.50
First National	Boston Curb	*70	*70	*70	Feb. '19, SA	0.15
Franklin	Boston	2¼	2¼	2¾	.....	....
Gadsden Copper	Boston Curb	1¼	*95	*95	.....	....
Granby Consol.	New York	32½	30	30	May '19, Q	1.25
Greene-Cananea	New York	34¾	32¾	32¾	Nov. '20, Q	0.50
Hancock	Boston	3	3	3	.....	....
Howe Sound	N. Y. Curb	3¾	3½	3½	Jan. '21, Q	0.05
Inspiration Consol.	New York	44¼	41¾	41¾	Oct. '20, Q	1.00
Iron Cap	Boston Curb	8	8	8	Sept. '20, K	0.25
Isle Royale	Boston	26	24½	24½	Sept. '19, SA	0.50
Kennecott	New York	38⅞	35¾	36	Dec. '20, Q	0.50
Keweenaw	Boston	3	2½	2½	.....	....
Lake Copper	Boston	5	4½	4½	.....	....
La Salle	Boston	1¾	1½	1½	.....	....
Magma Copper	N. Y. Curb	31½	28¾	28¾	Jan. '19, Q	0.50
Majestic	Boston Curb	*12	*10	*12	.....	....
Mason Valley	Boston	†2½	†2	2½	.....	....
Mass. Consolidated	Boston	4	3½	3½	Nov. '17, Q	1.00
Miami Copper	New York	31	29¼	29½	May '22 Q	0.50
Michigan	Boston	3	2½	3	.....	....
Mohawk	Boston	67⅜	66	66	Feb. '22, Q	1.00
Mother Lode Coa.	N. Y. Curb	10	9⅜	9½	.....	....
Nevada Consol.	New York	19	17⅜	17⅜	Sept. '20, Q	0.25
New Cornelia	Boston	20½	19¼	19½	May '22, K	0.25
North Butte	Boston	14⅜	13¼	13¼	Oct. '18, Q	0.25
North Lake	Boston	....	....	3	.....	....
Ohio Copper	N. Y. Curb	*9	*9	*9	.....	....
Old Dominion	Boston	27	25	25	Dec. '18, Q	1.00
Osceola	Boston	36½	36½	36½	June '20, Q	0.50
Phelps Dodge	Open Mar.	†185	†175	....	Apr. '22, Q	1.00
Quincy	Boston	49¼	47½	47½	Mar. '20, Q	1.00
Ray Consolidated	New York	18⅜	17	17½	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	2¼	1¾	1¾	.....	....
St. Mary's Min. Ld.	Boston	48	47½	48	Apr. '22, K	2.00
Seneca Copper	Boston	....	....	14	.....	....
Shannon	Boston	*95	*90	*90	Nov. '17, Q	0.25
Shattuck Arizona	New York	11⅞	10⅜	10⅜	Jan. '20, Q	0.25
South Lake	Boston	1¼	1¼	1¼	.....	....
Superior & Boston	Boston	1¼	1¼	1¼	.....	....
Tenn. C. & C. cfs	New York	12⅜	11¼	11¼	May '18, I	1.00
Tuolumne	Boston	*79	*70	*70	May '13,	0.10
United Verde Ex.	Boston Curb	30	28	28	May '22, Q	0.25
Utah Consol.	Boston	3½	3½	3½	Sept. '18,	0.25
Utah Copper	New York	68⅜	65½	65½	Mar. '22, Q	0.50
Utah Metal & T.	Boston	1½	1½	1½	Dec. '17,	0.30
Victoria	Boston	1¼	1¼	1¼	.....	....
Winona	Boston	1 1/16	1¼	1 1/16	.....	....
Wolverine	Boston	15	14¼	14¼	.....	....
NICKEL-COPPER						
Internat. Nickel	New York	18	16½	16¾	Mar. '19,	0.50
Internat. Nickel, pfd	New York	82	80	80	May. '22, Q	1.50
LEAD						
National Lead	New York	95½	93½	94½	Mar. '22, Q	1.50
National Lead, pfd	New York	109½	109⅛	109⅜	Mar. '22, Q	1.75
St. Joseph Lead	New York	15⅜	14¼	14¼	Mar. '22, Q	0.25
QUICKSILVER						
New Idria	Boston	1½	1½	1½	.....	....
ZINC						
Am. Z. L. & S.	New York	19⅜	18¼	18¼	May '20,	1.00
Am. Z. L. & S. pfd.	New York	46	44¼	44¼	Nov. '20, Q	1.50
Butte C. & Z.	New York	8¼	7½	7½	June '18,	0.50
Butte & Superior	New York	32¼	29¼	29¼	Sept. '20,	1.25
Callahan Zn-Ld.	New York	11¼	8¼	8¼	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	144½	143½	144	May '22, Q	2.00
Yellow Pine	Los Angeles	*54	*54	*54	Sept. '20, Q	0.03

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs. The Financial Press, N. Y.

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	⅛	⅛	⅛	.....	....
Alaska Juneau	New York	1½	1½	1½	.....	....
Carson Hill	New York	†15	†12	15	.....	....
Cresson Consol. G.	N. Y. Curb	2¼	2¼	2¼	Apr. '22, Q, X	$0.10
Dome Extension	Toronto	....	....	1	.....	....
Dome Mines	New York	29½	28	28	Apr. '22, Q	1.00
Florence Goldfield	N. Y. Curb	*19	*17	*17	.....	....
Golden Cycle	Colo. Springs	*80½	*78	*80½	June '21, Q	0.02
Goldfield Consol.	N. Y. Curb	....	....	*8	Dec. '19,	0.05
Hollinger Consol.	Toronto	9.60	9.25	9.30	May '22,	0.05
Homestake Mining	New York	71	70	71	May '22, M	0.25
Kirkland Lake	Toronto	*41	*35	*40	.....	....
Lake Shore	Toronto	2.26	2.04	2.10	Nov. '21, K	0.02
McIntyre-Porcupine	Toronto	17.75	17.20	17.45	May '22, K	0.05
Porcupine Crown	Toronto	*25	*22	*22½	July '17,	0.03
Porcupine V. N. T.	Toronto	*23	*21	*22½	.....	....
Portland	Colo. Springs	*25	*25	*25	Oct. '20, Q	0.01
Schumacher	Toronto	*65	*63	*64½	.....	....
Silver Pick	N. Y. Curb	*18	*17	*17	.....	....
Teck Hughes	Toronto	*52½	*48	*49	.....	....
Tom Reed	Los Angeles	*50	*50	*50	Dec. '19,	0.02
United Eastern	N. Y. Curb	1 1/16	1⅛	1⅛	Apr. '22, Q	0.15
Vindicator Consol.	Colo. Springs	....	....	*7	Jan. '20, Q	0.01
White Caps Mining	N. Y. Curb	*9	*9	*9	.....	....
Wright-Hargreaves	Toronto	2.85	2.60	2.75	Apr. '22,	0.02½
Yukon Gold	N. Y. Curb	1	*92	*92	June '18,	0.02½
SILVER						
Batopilas Mining	New York	1⅛	1⅛	1⅛	Dec. '07, I	0.12½
Beaver Consol.	Toronto	*31	*30	*30½	May '20, K	0.03
Coniagas	Toronto	1.30	1.20	1.25	May '21, Q	0.12½
Crown Reserve	Toronto	*17	*12	*15	Jan. '17,	0.05
Kerr Lake	N. Y. Curb	3⅜	3⅛	3⅛	Apr. '22, Q	0.12½
La Rose	Toronto	*37½	*32	*33	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*28	*21	*25	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	1.05	1.00	1.03	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	6½	6⅛	6⅛	Apr. '22, Q, X	0.30
Ontario Silver	New York	8¼	7⅞	7⅞	Jan. '19, Q	0.50
Ophir Silver	N. Y. Curb	....	....	*12	Jan. '12,	0.10
Temiskaming	Toronto	*30	*20	*29½	Jan. '20, K	0.04
Trethewey	Toronto	*4½	*3½	*4½	Jan. '19,	0.05
GOLD AND SILVER						
Boston & Montana	N. Y. Curb	*20	*17	*18	.....	....
Cash Boy	N. Y. Curb	*6	*6	*6	.....	....
Dolores Esperanza	N. Y. Curb	2¼	2¼	2¼	.....	....
El Salvador	N. Y. Curb	*5	*4	*4	.....	....
Jim Butler	N. Y. Curb	*6	*6	*6	Aug. '18, SA	0.07
Jumbo Extension	N. Y. Curb	....	....	*5	June '16,	0.05
MacNamara M.&M.	N. Y. Curb	*10	*7	*10	May '10,	0.02½
Tonopah Belmont	N. Y. Curb	1⅛	1 1/16	1⅛	Apr. '22, Q	0.05
Tonopah Divide	N. Y. Curb	*80	*76	*76	.....	....
Tonopah Extension	N. Y. Curb	1 1/16	1 1/16	1 1/16	Apr. '22, Q	0.05
Tonopah Mining	N. Y. Curb	1⅛	1⅛	1 1/16	Apr. '22, SA, X	0.07½
West End Consol.	N. Y. Curb	1½	1	1⅛	June '22, SA	0.05
SILVER-LEAD						
Caledonia	N. Y. Curb	....	....	*10	Jan. '21, M	0.01
Cardiff M. & M.	Salt Lake	*96	*94	*94	Dec. '20,	0.15
Chief Consol.	Boston Curb	5	4½	5	May '22, Q	0.05
Consol. M. & S.	Montreal	24	23½	24	Oct. '20, Q	0.62½
Daly Mining	Salt Lake	†2.00	†1.90	....	July '20, Q	0.10
Daly-West	Boston	2½	2½	2½	Dec. '20, Q	0.25
Eagle & Blue Bell	Boston Curb	3½	3½	3½	Apr. '21, K	0.05
Electric Point	Spokane	*9½	*8	*8	May '20, SA	0.03
Federal M. & S.	New York	†14½	†10	14½	Jan. '09,	1.50
Federal M. & S. pfd.	New York	51½	49½	49½	Mar. '22, Q	1.00
Florence Silver	Spokane	*22½	*22½	*22½	Apr. '19,	0.01½
Grand Central	Salt Lake	†*61	†*60	*60	Jan. '21, K	0.01
Hecla Mining	N. Y. Curb	6¾	6⅜	6⅜	Mar. '22, Q	0.15
Iron Blossom Con.	N. Y. Curb	*24	*22	*24	Apr. '22, Q	0.02½
Judge M. & S.	Salt Lake	†2.75	†2.50	2.60	Sept. '20, Q	0.12½
Marsh Mines	N. Y. Curb	*28	*17	*20	June '21, I	0.02
Prince Consol.	Salt Lake	†*5½	†*4½	*5½	Nov. '17,	0.02½
Rambler-Cariboo	Spokane	*6½	*6	*6	Feb. '19,	0.01
Rex Consol.	N. Y. Curb	*11	*9	*9	.....	....
Standard Silver-Ld.	N. Y. Curb	*20	*20	*20	Oct. '17,	0.05
Stewart Mines	N. Y. Curb	*9	*7	*8	Dec. '15,	0.05
Tamarack-Custer	Spokane	2.62	2.55	2.62	Jan. '21, K	0.04
Tintic Standard	Salt Lake	2.12½	2.07½	2.12½	Dec. '21, Q	0.05
Utah Apex	Boston	3½	2½	3	Nov. '20, K	0.25
Wilbert Mining	N. Y. Curb	....	....	*2	Nov. '17,	0.01
VANADIUM						
Vanadium Corp.	New York	52½	48½	48½	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	57½	56	57½	Apr. '22, Q	1.50
Asbestos Corp. pfd.	Montreal	78	78	78	Apr. '22, Q	1.75
SULPHUR						
Freeport, Texas	New York	26¼	23¾	24	Nov. '19, Q	1.00
Texas Gulf	New York	52	46½	46½	Mar. '22, QX	1.00
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	65½	60	60½	Mar. '21, Q	1.00
Amer. Sm.& Ref. pf.	New York	98½	96½	97½	June '22 Q	1.75
Am. Sm. Sec. pf. A.	New York	93½	93¼	93½	Apr. '22, Q	1.50
U. S. Sm. R. & M.	New York	44¼	41⅛	41⅛	Jan. '21, Q	0.50
U.S. Sm.R.& M. pf.	New York	47⅛	47	47⅛	Apr. '22, Q	1.75

NEW MACHINERY AND INVENTIONS

Arc Welding a Mine Pipe Line

Method Used at Property in Central America Proves Effective and Saves Expense of New Installation

BY A. M. CANDY

A GENERAL VIEW of the mill and camp of the Honduras Rosario Mining Co., San Juancito, Honduras, is shown in an accompanying cut. The water pipe line which supplies the Guadulupe plant has been in service for a number of years, most of it having been placed on the surface of the ground over the mountains, as a result of which the pipe sections became so badly corroded that it was necessary to make extensive replacements or repairs.

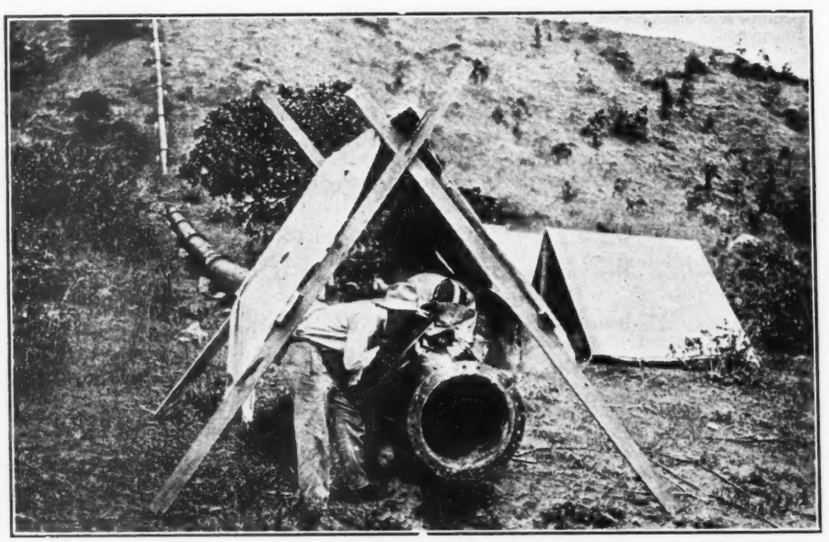
Mill and camp of Honduras Rosario Mining Co.

After a preliminary examination of the pipe line the operators thought that only approximately 400 ft. of the pipe would require repairing. However, upon more extensive examination it was found that practically the entire line would require extensive repairs. The total line is somewhat over 3,000 ft. long, the pipe being 22 in. internal diameter, of the built-up riveted type, constructed of 6½-ft. steel plate built into pipe sections 30 ft. long. Each section of pipe is provided with a steel flange riveted to the end of the pipe to form a coupling for joining the various lengths of pipe to one another.

Part of welded pipe and native workmen

In some places this pipe was found to have rusted so badly that the remaining section of metal was as thin as a sheet of ordinary paper. In other places the pipe was found to be in perfect condition. The question naturally arose as to whether it would be cheaper to buy and install new pipe or attempt to repair the old pipe. To find the expense of repairing by the electric arc-welding process, one of the badly corroded sections of pipe was removed from the line and repaired by forming steel plates for patches which were bent to the proper curvature and applied on the outside of the pipe. These were welded to the pipe around the edge of the patch by means of the Westinghouse arc-welding equipment, as shown in the accompanying illustration. A careful check was kept on the cost of doing this repair work, and after the work was finished everyone was surprised to find that the piece of repaired pipe, made practically as good as new, cost only approximately one-tenth of the amount involved to purchase and transport a new length of pipe to the location where the welding work was done. The operators therefore decided to go ahead with the project of repairing the entire pipe line.

To carry on this work the pipe line was disconnected at every third joint, so as to leave sections of 90 ft. of continuous pipe in each piece. These sections could be readily turned around on the pliers on which they were originally



Arc welder at work on old water pipe

installed. The defective places in the pipe were then marked off and plates cut out to the required size and bent so that they could be applied over the places in the pipe on the outside thereof. These plates were then welded to the pipe by running a full fillet of deposited metal around the edge of the plate, which tied it securely to the shell of the pipe. After each 90-ft. length of pipe was finished it was tested to double the working pressure, and barring a few beads of moisture occurrring in a few places, the pipe was otherwise satisfactory. These leaks were easily stopped by a few light blows from a machinist's hammer.

Any other method of repairing this pipe was impracticable because the rivet heads were corroded to such an extent that the rough treatment to which they would have been subjected during the operation of attempting to rivet on patches would have resulted in innumerable leaks around the rivets. Furthermore, the patches required on many of the lengths of pipe were so numerous that to attempt to rivet on patches would have been prohibitive in cost.

Temporary tents and awnings were put up to protect the welding equipment during the night from the weather, and also to protect the operators during the daytime, and from the wind, which would make it difficult to carry on the welding operation in the open country. Transformers were required to be installed to step down the transmission line voltage of 2,200-v. to 440-v. required by the motor of the portable arc-welding equipment.

All of the welding work proper was performed by native Hondurans, who, when they have a mechanical turn of mind, have been found to make excellent arc-welding operators. However, the operating characteristics of this particular welding equipment which make it easy for an operator to strike and hold an arc and at the same time cause the deposited metal to produce deep penetration and good fusion with the plate material must not be overlooked.

Ventilating Tubing for Mines

Successful operation, under severe underground conditions, of the new fabric ventilation tubing for mines, Ventube, is reported by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. One test given this material was carried out in a large Butte copper mine on the 1,600 level, about 1,000 ft. from the shaft. The temperature there was 112 deg. F., the air absolutely still and the acid-water drip excessive—conditions ideal for fungus growth and chemical corrosion. At the end of seven months this sample of Ventube was removed and found to be in as good and serviceable a condition as when originally installed for the test. Other sections hung underground in 1919 are still delivering air and are in good working condition. Reports from users show it is not extraordinary to get an increased production of 50 per cent output where Ventube has been installed.

Ventube was produced by the du Pont company as a result of researches and studies made at the request of Western copper interests, who were looking for an efficient flexible tubing to increase production in underground workings.

As a result of practical tests and of the increased use of Ventube, interesting information has been compiled in a series of tables and charts, by which any one can determine the Ventube equipment necessary to meet any given condition, embracing carefully worked out data for fans and tubes of different capacities and diameters.

New Arc-Weld Bonds

Two new rail bonds, for arc-weld application, have been developed by the Ohio Brass Co., Mansfield, Ohio. They are known as Type AW-7, for base of rail application, and Type AW-8 for ball of rail application. They are shown in Figs. 1 and 2 respectively.

The AW-8 bond consists of two copper strands formed into a U and welded into steel terminals which in turn are welded to the rail. The AW-7 bond is the same in principle. It has a single strand, of any desired length, welded into suitable steel terminals. It is a proved fact that steel to steel is the easiest kind of electric welding, and the new bonds conform to this principle.

The steel terminals are slightly rounded, and provide a wide angle or scarf in which to build the weld. The steel is heavy, and will not be burned through by the arc. A copper sleeve, which surrounds the strands at the terminal, shields the wires and absorbs vibration.

Fig. 1. Type AW-7 rail bond

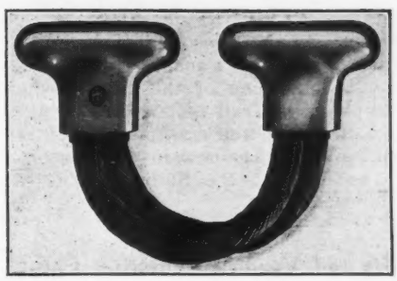


Fig. 2. Type AW-8 rail bond

Flexible Steel Belt Lacing

A flexible steel belt lacing which is suitable for use with belts up to $\frac{1}{2}$ in. in thickness is manufactured by the Flexible Steel Lacing Co., 4607 Lexington St., Chicago, Ill. This product is known as the "Alligator," and claims a number of advantages, among which are: Stronger than other joints; a separable hinge joint; quick application, and long life.

INDUSTRIAL NOTES

The Titan Iron & Steel Co., Inc., of Newark, N. J., manufacturing mechanically puddled wrought iron, has announced the appointment of W. Woodward Williams as vice-president.

Recent sales of Ruggles-Coles driers include the following: An ore drier to the Mutual Chemical Co. of America, Baltimore, Md.; Class A-2 drier for drying crushed limestone to the Peerless White Lime Co., Mosher, Mo.; Class A-10 drier for the drying of coal, to the Graphite Mines Corporation, Providence, R. I.; Class A-2 drier for drying coal at a large cement plant in Japan.

The Pulverized-Fuel Department of the Quigley Furnace Specialties Co. has lately been operated as the Quigley Fuel Systems Department of Hardinge Co., Inc. This pulverized-fuel business has now been incorporated as the Quigley Fuel Systems, Inc., with general officers at 26 Cortlandt St., New York City. William H. Baker is president, W. O. Renkin, managing engineer, and L. W. Marso represents the company in the Pittsburgh district. The new company is entirely independent of the Hardinge Co., although Mr. Baker continues as vice-president and consulting engineer for the Hardinge Co.

Industrial Advertising Conference

The First Annual Industrial Advertising Conference is to be held at Milwaukee, Wis., June 11 to 15, in connection with the Eighteenth Annual Convention of the Associated Advertising Clubs of the World. The program will be of definite interest to the sales and advertising executives of industrial companies generally, particularly those dealing with raw materials, machinery, and other products which are sold to other industries. The program is focused upon inter-industrial marketing, and this will be the first time that this phase of selling and advertising has been given proper attention at these conventions.

The following papers will be presented: "Advertising as a Factor in Inter-industrial Marketing," Max W. Babb; "What the U. S. Department of Commerce Is Doing to Aid Inter-industrial Marketing," by F. M. Feiker; "Cutting the Costs of Distribution," by the Hon. Sydney Anderson; "Advertising in Its Relation to the Four Points of Contact in Industry," by Bennett Chapple; "Advertising the Technical

Product to the Non-Technical Buyer," by Charles H. Mackintosh; "Selling to the Professional Man in Industry," by J. C. McQuiston; "Expanding the Markets for Raw Materials," by H. Colin Campbell; "Putting Ideas Into Industrial Advertising," by W. Lee, and "The Outlook for Business in the Industrial Field," by Edwin F. Gay.

TRADE CATALOGS

Gears and Pinions.—Circular 1,579-B, containing general information and technical data for cutting micarta gears and pinions, has recently been issued by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. The book contains a great amount of useful information for gear manufacturers. Micarta, a non-metallic material for gear and pinion application that can be advantageously substituted for untreated steel, cast iron, bronze, and all other materials used for gearing, has been developed by the Westinghouse Electric & Manufacturing Co.

Spectrometers.—A description of the Hilger chemical spectrometer is given in a 4-pp. leaflet issued by Adam Hilger, Ltd., 75A Camden Road, London, N. W. 1, England. The following features are claimed for this chemical spectrometer: lower cost, compactness, economy of table space, and convenience in manipulation; readings direct in wave lengths, to an average accuracy of 0.15 micromillimetres.

CONSTRUCTION NEWS

Palmarito Company to Build 500-Ton Mill

Two Other Plants of Small Capacity Recently Erected—Hydro-electric Station Under Construction

The Cia. Minera de Palmarito, in the Mocorito district, Sinaloa, Mexico, is doing development work on a large scale with a view to installing a 500-ton mill and cyanide plant at the close of the rainy season, which begins in July. This property is said to have a large silver deposit. W. D. Blackmer is vice-president and in charge at the mine. J. L. Cadogan is general superintendent. The company's address is Mocorito, Sinaloa.

A group of properties in the Mautal section of the Badiraguato district, Sinaloa, Mexico, is being worked by Milward and Haggin, of Culiacan, Sinaloa. These properties have been operated only for the last ten years, during which time they were worked for the shipping ores alone. The present owners have recently installed a ten-stamp mill and cyanide plant. This plant will treat about forty tons daily of a free milling gold and silver ore by plate amalgamation and cyanide.

In the Cosala district of Sinaloa, the mine being operated by E. A. Montgomery and associates is being worked at capacity. They have erected a new flotation mill, which is expected to treat the extremely complex ores successfully. This is a silver property with low ratio of gold values.

At the mines of Jesus Maria y Anexas, at San Jose de Gracia, in the Sinaloa district of the State of Sinaloa, Miguel Tarriba is installing a hydro-electric plant of 300-hp. capacity, with which to operate the mine and mill. Wood has been the fuel in the past, but has become so scarce as to be prohibitive in price. This property is equipped with a 100-ton stamp mill and an all-slimes cyanide plant, and has a record of a good many millions of dollars in gold production.

Rand Company to Enlarge Mill

The Geduld Proprietary Mines, Ltd., has decided to increase the capacity of its mill on the Rand, South Africa, from 40,000 to 65,000 tons monthly. The company's head office is at Pinners Hall, Austin Friars, London. The present plant includes 100 stamps, tube mills, and cyanide equipment.

Small Cyanide Plant Planned for Tombstone Property

It is proposed to build a fifty-ton cyanide plant at the Mamie property near Tombstone, Ariz. A lease has been taken on this by Frank Cavanagh.

Consolidated to Increase Shop Equipment at Trail

Plans of the Consolidated Mining & Smelting Co. of Canada, Trail, B. C., include extension of the machine-shop equipment at Trail with a view to manufacturing as much as possible of the equipment to be used in the new mill to be built at the Sullivan mine, at Kimberley, B. C.

United Verde's Crushing Plant to Handle 500 Tons an Hour

The new crushing plant of the United Verde Copper Co., below Jerome, Ariz., is designed to crush 500 tons an hour. In the primary breaking section are four crushers, with 34 x 26-in. jaws. In the second stage are three fine reduction crushers, and the operation then is finished by 54 x 24-in. heavy-duty rolls, specially designed for handling extremely hard ore. David Cole, the designer, states that fine crushing for roasting is a new departure in the Southwest. He is also remodeling the concentrator of the Cananea Consolidated Copper Co., at Cananea, Sonora, at a cost of $800,000. He superintended construction of the mill in 1904, and since then has remodeled it three times.

Durgy Mine, in North Carolina, to Have Concentrator

T. G. Pool, the principal owner of the old Durgy mine, in Person County, N. C., is planning to resume development and to install electric power and a mill with flotation equipment. The mine is now opened to 515 ft. in depth and a large tonnage of milling ore has been developed. The last operations were by the Tennessee Copper Co. which shipped the siliceous ores to Copper Hill, Tenn. The mine has been in operation intermittently since 1850. None of the other mines in the Virgilina district are now operating. The ore is about 2½ per cent copper, with gold and silver amounting to $2 to $3 per ton.

During the war the Navy branch at Norfolk, Va., extended the railroad to the Durgy mine and shipped out more than 50,000 tons of dump and tailings for constructional purposes at the naval base. The property was recently examined for the owners by Kirby Thomas, of New York City.

Cori Gold Will Equip Property

The Cori Gold Mines Co. is planning to build a permanent camp at its property near Acoponeta, Nayarit, Mexico. A compressor and milling machinery will be installed. The office of the company is 318 Symons Building, Spokane, Wash. Raymond Guyer is vice-president and consulting engineer.

United Verde Co. May Build Flotation Plant

An unconfirmed rumor is in circulation that the United Verde Copper Co., of Jerome, Ariz., is considering the erection of a flotation mill for handling low-grade sulphides midway in value between the furnace ores and the leaching ores that now are going into heaps on the plain. Concentration experiments have been proceeding for more than two years. Much concentrating ore may come from the steam-shovel operations, which lately were speeded up.

Right Good Company Completes Zinc-Lead Milling Plant

The Right Good Mining Co., composed principally of investors from Clay Center, Kan., has completed and placed in operation a new concentrator on a forty-acre lease southwest of Hockerville, Okla., just east of the Blue Bonnet mine.

Aërial Tramway Needed

The mill of the Aztec Gold Mines Co., at Baldy, N. M., is being remodeled, and the company is in the market for a small-tonnage aërial tramway. Later, if expectations are realized, the company hopes to build a 500-ton mill, which would require a Diesel-engine-driven electric power plant, also the usual equipment for a gold-milling plant using amalgamation, concentration and flotation.